160 TS

ARCMASTER®

INVERTER ARC WELDER

Service Manual

Revision: AB **Issue Date:** June 16, 2006 **Manual No:** 0-4881B

Operating Features:

GTAW | SMAW | 1 PHASE | 50/60 Hz | INVERTER | 115 V | 230 V | DC | CC

WE APPRECIATE YOUR BUSINESS!

Congratulations on your new Thermal Arc® product. We are proud to have you as our customer and will strive to provide you with the best service and reliability in the industry. This product is backed by our extensive warranty and world-wide service network. To locate your nearest distributor or service agency call 800-752-7621, or visit us on the web at **www.thermalarc.com**.

This Operating Manual has been designed to instruct you on the correct use and operation of your Thermal Arc® product. Your satisfaction with this product and its safe operation is our ultimate concern. Therefore, please take the time to read the entire manual, especially the Safety Precautions. They will help you to avoid potential hazards that may exist when working with this product.

YOU ARE IN GOOD COMPANY!

The Brand of Choice for Contractors and Fabricators Worldwide.

Thermal Arc® is a Global Brand of Arc Welding Products for Thermadyne Industries Inc. We manufacture and supply to major welding industry sectors worldwide including; Manufacturing, Construction, Mining, Automotive, Aerospace, Engineering, Rural and DIY/Hobbyist.

We distinguish ourselves from our competition through market-leading, dependable products that have stood the test of time. We pride ourselves on technical innovation, competitive prices, excellent delivery, superior customer service and technical support, together with excellence in sales and marketing expertise.

Above all, we are committed to develop technologically advanced products to achieve a safer working environment within the welding industry.

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgment, the Manufacturer assumes no liability for its use.

Service Manual Number 0-4881B for:
ArcMaster 160 TS Inverter Welding Power Supply Part No. 10-3067

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Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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SECTION 1:
SAFETY INSTRUCTIONS AND WARNINGS

WARNING

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING / INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment.

CONNECTED TO POWER LINES; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outline in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions. **HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.**

1.01 Arc Welding Hazards

WARNING

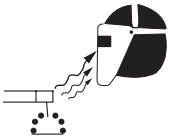
ELECTRIC SHOCK can kill

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersize, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.

14. Wear a safety harness to prevent falling if working above fool level.

15. Keep all panels and covers securely in place.



WARNING

ARC RAYS can burn eyes and skin; NOISE can damage hearing.
Arc rays from the welding process produce intense heat and strong ultraviolet rays that can eyes and skin.
Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.

2. Wear approved safety glasses. Side shields recommended.

3. Use protective screens or barriers to protect others from flash and flare; warn others not to watch the arc.

4. Wear protective clothing made from durable, flame-resistant material (wool and lather) and foot protection.

5. Use approved ear plugs or ear muffs if noise level is high.

WARNING

FUMES AND GASES can be hazardous your health.
Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

1. Keep your head out of the fumes. Do not breath the fumes.

2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.

3. If ventilation is poor, use an approved air-supplied respirator.

4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.

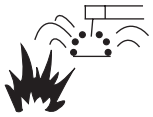
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.

Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.

Welding or cutting	*Electrode Size*	*Filter*	*Welding or cutting*	*Electrode Size*	*Filter*
Torch soldering		2	**Gas metal-arc**		
Torch brazing		3 or 4	Non-ferrous base metal	All	11
Oxygen Cutting			Ferrous base metal	All	12
Light	Under 1 in., 25mm	3 or 4	Gas tungsten arc welding	All	12
Medium	1 to 6 in., 25-150mm	4 or 5	(TIG)	All	12
Heavy	Over 6 in., 150mm	5 or 6	Atomic hydrogen welding	All	12
Gas welding			Carbon arc welding	All	12
Light	Under 1/8 in., 3mm	4 or 5	Plasma arc welding		
Medium	1/8 to 1/2 in., 3-12mm	5 or 6	**Carbon arc air gouging**		
Heavy	Over 1/2 in., 12mm	6 or 8	Light		12
Shielded metal-arc	Under 5/32 in., 4mm	10	Heavy		14
	5/32 to 1/4 in.,	12	**Plasma arc cutting**		
	Over 1/4 in., 6.4mm	14	Light	Under 300 Amp	9
			Medium	300 to 400 Amp	12
			Heavy	Over 400 Amp	14

6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to from highly toxic and irritating gases.

7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.



WARNING

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal,weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.

2. Do not weld where flying sparks can strike flammable material.

3. Remove all flammables within 35 ft (10.7m) of the welding arc. If this is not possible, tightly cover them with approved covers.

4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.

5. Watch for fire, and keep a fire extinguisher nearby.

6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.

7. Do not weld on closed containers such as tanks or drums.

8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.

9. Do not use welder to thaw frozen pipes.

10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.

WARNING

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal. As weld cool, they can throw off slag.

1. Wear approved face shield or safety goggles. Side shields recommended.

2. Wear proper body protection to protect skin.

WARNING

CYLINDERS can explode if damaged.

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.

2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.

3. Keep cylinders away from any welding or other electrical circuits.

4. Never allow a welding electrode to touch any cylinder.

5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.

6. Turn face away from valve outlet when opening cylinder valve.

7. Keep protective cap in place over valve except when cylinder is in use or connected for use.

8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed Safety Standards.

WARNING

Engines can be dangerous.

WARNING

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.
2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

WARNING

ENGINE FUEL can cause fire or explosion.

Engine fuse is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank – allow room for fuel to expand.
5. Do not spill fuel. If fuel is spilled, clean up before stating engine.

WARNING

MOVING PARTS can cause injury.

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

WARNING

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always ware a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and -) on batteries.

WARNING

STEAM AND PRESSURIZED HOT COOLANT can burn face , eyes,and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

WARNING

This product, when used for welding or cutting, produces fumes or gases which contain chemicals know to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety code sec. 25249.5 et seq.)

NOTE

Considerations About Welding And The Effects of Low Frequency Electric and Magnetic Fields.

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields-Background Paper, OTA-BP-E-63 (Washington, DC; U.S. Government Printing Office, MAY 1989): "…there is now a very large volume of scientific findings based on experiment at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields and interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risk."

To reduce magnetic fields in the workplace, use the following procedures.

1. Keep cables close together by twisting or taping them.

2. Arrange cables to one side and away from the operator.

3. Do not coil or drape cable around the body.

4. Keep welding power source and cables as far away from body as practical.

ABOUT PACEMAKERS:

The above procedures are among those also normaly recommended for pacemaker wearers. Consult your doctor for complete information.

1.02 PRINCIPAL SAFETY STANDARDS

Safety in Welding and Cutting, ANSI Standard Z49.1, from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA, 29CFR 1910, SAFETY AND HEALTH STANDARDS, obtainable from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWSF4.1, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.

National Electrical Code, NFPA Standard 70, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.03 PRECAUTIONS DE SECURITE EN SOUNDAGE A L'ARC

MISE EN GARD

LE SOUDAGE A L'ARC EST DANGEREUX
PROTEGEZ-VOUS, AINSI QUE LES AUTRES, CONTRE LES BLESSURES GRAVES POSSIBLES OU LA MORT. NE LAISSEZ PAS LES ENFANTS S'APPROCHER, NI LES PORTEURS DE STIMULATEUR CARDIAQUE (A MOINS QU'ILS N'AIENT CONSULTE UN MEDECIN). CONSERVEZ CES INSTRUCTIONS. LISEZ LE MANUEL D'OPERATION OU LES INSTRUCTIONS AVANT D'INSTALLER, UTILISER OU ENTRETENIR CET EQUIPEMENT.
Les produits et procédés de soudage peuvent sauser des blessures graves ou la mort, de meme que des dommages au reste du matériel et à la propriété, si l'utilisateur n'adhère pas strictement à toutes les règles de sécurité et ne prend pas les précautions nécessaires.

En soudage et coupage, des pratiques sécuritaires se sont développées suite à l'expérience passée. Ces pratiques. doivent être apprises par étude ou entrainement avant d'utiliser l'equipement. Toute personne n'ayant pas suivi un entraînement intensif en soudage et coupage ne devrait pas tenter de souder. Certaines pratiques concernent les équipements raccordés aux lignes d'alimentation alors que d'autres s'adressent aux groupes électrogènes.

La norme Z49.1 de l'American National Standard, intitulée "SAFETY IN WELDING AND CUTTING" présente les pratiques sécuritaires à suivre. Ce document ainsi que d'autres guides que vous devriez connaître avant d'utiliser cet équipement sont présentés à la fin de ces instructions de sécurité.

SEULES DES PERSONNES QUALIFIEES DOIVENT FAIRE DES TRAVAUX D'INSTALLATION, DE REPARTION, D'ENTRETIEN ET D'ESSAI

1.04 Dangers relatifs au soudage à l'arc

AVERTISSEMENT

L'ELECTROCUTION PEUT ETRE MORTELLE.

Une décharge électrique peut tuer ou brûler gravement. L'électrode et le circuit de soudage sont sous tension dès la mise en circuit. Le circuit d'alimentation et les circuits internes de l'équipement sont aussi sous tension dés la mise en marche. En soudage automatique ou semi-automatique avec fil, ce dernier, le rouleau ou la bobine de fil, le logement des galets d'entrainement et toutes les pièces métalliques en contact avec le fil de soudage sont sous tension. Un équipement inadéquatement installé ou inadéquatement

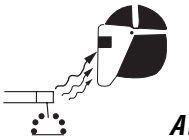
mis à la terre est dangereux.

1. Ne touchez pas à des pièces sous tension.
2. Portez des gants et des vêtements isolants, secs et non troués.
3. Isolez-vous de la pièce à souder et de la mise à la terre au moyen de tapis isolants ou autres.
4. Déconnectez la prise d'alimentation de l'équipement ou arrêtez le moteur avant de l'installer ou d'en faire l'entretien. Bloquez le commutateur en circuit ouvert ou enlevez les fusibles de l'alimentation afin d'éviter une mise en marche accidentelle.
5. Veuillez à installer cet équipement et à le mettre à la terre selon le manuel d'utilisation et les codes nationaux, provinciaux et locaux applicables.
6. Arrêtez tout équipement après usage. Coupez l'alimentation de l'équipement s'il est hors d'usage ou inutilisé.
7. N'utilisez que des porte-électrodes bien isolés. Ne jamais plonger les porte-électrodes dans l'eau pour les refroidir. Ne jamais les laisser traîner par terre ou sur les pièces à souder. Ne touchez pas aux porteelectrodes raccordes à deux sources de courant en même temps. Ne jamais toucher quelqu'un d'autre avec l'électrode ou le porte-électrode.
8. N'utilisez pas de cables électriques usés, endommagés, mal épissés ou de section trop petite.
9. N'enroulez pas de câbles électriques autour de votre corps.
10. N'utilisez qu'une bonne prise de masse pour la mise à la terre de la pièce à souder.
11. Ne touchez pas à l'électrode lorsqu'en contact avec le circuit de soudage (terre).
12. N'utilisez que des équipements en bon état. Réparez ou remplacez aussitôt les pièces endommagées.
13. Dans des espaces confinés ou mouilles, n'utilisez pas de source de courant alternatif, à moins qu'il soit

muni d'un réducteur de tension. Utilisez plutôt une source de courant continu.

14. Portez un harnais de sécurité si vous travaillez en hauteur.

15. Fermez solidement tous les panneaux et les capots.



AVERTISSEMENT

LE RAYONNEMENT DE L'ARC PEUT BRÛLER LES YEUX ET LA PEAU; LE BRUIT PEUT ENDOMMAGER L'OUIE.
L'arc de soudage produit une chaleur et des rayons ultraviolets intenses, susceptibles de brûler les yeux et la peau. Le bruit causé par certains procédés peut endommager l'ouïe.

1. Portez une casque de soudeur avec filtre oculaire de nuance appropriee (consultez la norme ANSI Z49 indiquee ci-aprés) pour vous protéger le visage et les yeux lorsque vous soudez ou que vous observez l'exécution d'une soudure.

2. Portez des lunettes de sécurité approuvées. Des écrans latéraux sont recommandés.

3. Entourez l'aire de soudage de rideaux ou de cloisons pour protéger les autres des coups d'arc ou de l'éblouissement; avertissez les observateurs de ne pas regarder l'arc.

4. Portez des vêtements en matériaux ignifuges et durables (laine et cuir) et des chaussures de sécurité.

5. Portez un casque antibruit ou des bouchons d'oreille approuvés lorsque le niveau de bruit est élevé.

AVERTISSEMENT

LES VAPEURS ET LES FUMEES SONT DANGEREUSES POUR LA SANTE.
Le soudage dégage des vapeurs et des fumées dangereuses à respirer.

SELECTION DES NUANCES DE FILTRES OCULAIRS POUR LA PROTECTION DES YEUX EN COUPAGE ET SOUDAGE (selon AWS à 6.2-73)

Opération de coupage ou soudage	Dim ension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filter oculaire	Opération de coupage ou soudage	Dim ension d'électrode ou Epiasseur de métal ou Intensité de courant	Nuance de filter oculaire
Brassage tender au chalumeau	Toutes conditions	2	Soudage á l'arc sous gaz avec fil plein (GMAW)		
Brassage fort au chalumeau	Toutes conditions	3 ou 4	métaux non-ferreux	Toutes conditions	11
Oxycoupage			métaux ferreux	Toutes conditions	12
mince	moins de 1 po. (25mm)	3 ou 4	Soudage á l'arc sous gaz avec électrode de tungstène (GTAW)	Toutes conditions	12
moyen	de 1 à 6 po. (25 à 150mm)	4 ou 5	Soudage á l'hydrogène atomique (AHW)	Toutes conditions	12
épais	plus de 6 po. (150mm)	5 ou 6	Soudage á l'arc avec électrode de carbone (CAW)	Toutes conditions	12
Soudage auxgaz			Soudage á l'arc Plasma (PAW)	Toutes conditions	12
mince	moins de 1/8 po. (3mm)	4 ou 5	Gougeage Air-Arc avec électrode de carbone		
moyen	de 1/8 à 1/2 po. (3 à 12mm)	5 ou 6	mince		
épais	plus de 1/2 po. (12mm)	6 ou 8	épais		12
Soudage á l'arc avec électrode enrobes (SMAW)	monis de 5/32 po. (4mm)	10	Coupage á l'arc Plasma (PAC)		14
	5/32 à 1/4 po. (4 à 6.4mm)	12	mince	monis de 300 amperés	9
	plus de 1/4 po. (6.4mm)	14	moyen	de 300 á 400 amperés	12
			épais	plus de 300 amperés	14

1. Eloignez la tete des fumées pour éviter de les respirer.

2. A l'intérieur, assurez-vous que l'aire de soudage est bien ventilée ou que les fumees et les vapeurs sont aspirées à l'arc.

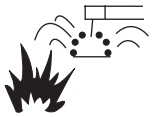
3. Si la ventilation est inadequate, portez un respirateur à adduction d'air approuvé.

4. Lisez les fiches signalétiques et les consignes du fabricant relatives aux métaux, aux produits consummables, aux revêtements et aux produits nettoyants.

5. Ne travaillez dans un espace confiné que s'il est bien ventilé; sinon, portez un respirateur a adduction d'air. Les gaz protecteurs de soudage peuvent déplacer l'oxygène de l'air et ainsi causer des malaises ou la mort. Assurez-vous que l'air est propre a la respiration.

6. Ne soudez pas à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir avec des vapeurs et former des gaz hautement toxiques et irritants.

7. Ne soudez des tôles galvanisées ou plaquées au plomb ou au cadmium que si les zones à souder ont été grattées à fond, que si l'espace est bien ventilé; si nécessaire portez un respirateur à adduction d'air. Car ces revêtements et tout métal qui contient ces éléments peuvent dégager des fumées toxiques au moment du soudage.



AVERTISSEMENT

LE SOUDAGE PEUT CAUSER UN INCENDIE OU UNE EXPLOSION.
L'arc produit des étincellies et des projections. Les particules volantes, le métal chaud, les projections de soudure et l'équipement surchauffé peuvent causer un incendie et des brûlures. Le contact accidentel de l'électrode ou du fil-électrode avec un objet métallique peut provoquer des étincelles, un échauffement ou *un incendie.*

1. Protégez-vous, ainsi que les autres, contre les étincelles et du métal chaud.

2. Ne soudez pas dans un endroit où des particules volantes ou des projections peuvent atteindre des matériaux inflammables.

3. Enlevez toutes matières inflammables dans un rayon de 10, 7 mètres autour de l'arc, ou couvrez-les soigneusement avec des bâches approuvées.

4. Méfiez-vous des projections brulantes de soudage susceptibles de pénétrer dans des aires adjacentes par de petites ouvertures ou fissures.

5. Méfiez-vous des incendies et gardez un extincteur à portée de la main.

6. N'oubliez pas qu'une soudure réalisée sur un plafond, un plancher, une cloison ou une paroi peut enflammer l'autre côté.

7. Ne soudez pas un récipient fermé, tel un réservoir ou un baril.

8. Connectez le câble de soudage le plus près possible de la zone de soudage pour empêcher le courant de suivre un long parcours inconnu, et prévenir ainsi les risques d'électrocution et d'incendie.

9. Ne dégelez pas les tuyaux avec un source de courant.

10. Otez l'électrode du porte-électrode ou coupez le fil au tube-contact lorsqu'inutilisé après le soudage.

11. Portez des vêtements protecteurs non huileux, tels des gants en cuir, une chemise épaisse, un pantalon revers, des bottines de sécurité et un casque.

AVERTISSEMENT

LES ETINCELLES ET LES PROJECTIONS BRULANTES PEUVENT CAUSER DES BLESSURES.
Le piquage et le meulage produisent des particules métalliques volantes. En refroidissant,
la soudure peut projeter du éclats de laitier.

1. Portez un écran facial ou des lunettes protectrices approuvées. Des écrans latéraux sont recommandés.

2. Portez des vêtements appropriés pour protéger la peau.

AVERTISSEMENT

LES BOUTEILLES ENDOMMAGEES PEUVENT EXPLOSER.

Les bouteilles contiennent des gaz protecteurs sous haute pression. Des bouteilles endommagées peuvent exploser. Comme les bouteilles font normalement partie du procédé de soudage, traitez-les avec soin.

1. Protégez les bouteilles de gaz comprimé contre les sources de chaleur intense, les chocs et les arcs de soudage.

2. Enchainez verticalement les bouteilles à un support ou à un cadre fixe pour les empêcher de tomber ou d'être renversées.

3. Eloignez les bouteilles de tout circuit électrique ou de tout soudage.

4. Empêchez tout contact entre une bouteille et une électrode de soudage.

5. N'utilisez que des bouteilles de gaz protecteur, des détendeurs, des boyauxs et des raccords conçus pour chaque application spécifique; ces équipements et les pièces connexes doivent être maintenus en bon état.

6. Ne placez pas le visage face à l'ouverture du robinet de la bouteille lors de son ouverture.

7. Laissez en place le chapeau de bouteille sauf si en utilisation ou lorsque raccordé pour utilisation.

8. Lisez et respectez les consignes relatives aux bouteilles de gaz comprimé et aux équipements connexes, ainsi que la publication P-1 de la CGA, identifiée dans la liste de documents ci-dessous.

AVERTISSEMENT

LES MOTEURS PEUVENT ETRE DANGEREUX LES GAZ D'ECHAPPEMENTDES MOTEURS PEUVENT ETRE MORTELS.

Les moteurs produisent des gaz d'échappement nocifs.

1. Utilisez l'équipement à l'extérieur dans des aires ouvertes et bien ventilées.

2. Si vous utilisez ces équipements dans un endroit confiné, les fumées d'échappement doivent être envoyées à l'extérieur, loin des prises d'air du bâtiment.

AVERTISSEMENT

LE CARBURANT PEUR CAUSER UN INCENDIE OU UNE EXPLOSION. Le carburant est hautement inflammable.

1. Arrêtez le moteur avant de vérifier le niveau e carburant ou de faire le plein.
2. Ne faites pas le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.

3. Si c'est possible, laissez le moteur refroidir avant de faire le plein de carburant ou d'en vérifier le niveau au début du soudage.

4. Ne faites pas le plein de carburant à ras bord: prévoyez de l'espace pour son expansion.

5. Faites attention de ne pas renverser de carburant. Nettoyez tout carburant renversé avant de faire démarrer le moteur.

AVERTISSEMENT

DES PIECES EN MOUVEMENT PEUVENT CAUSER DES BLESSURES. Des pièces en mouvement, tels des ventilateurs, des rotors et des courroies peuvent couper doigts et mains, ou accrocher des vêtements amples.

1. Assurez-vous que les portes, les panneaux, les capots et les protecteurs soient bien fermés.

2. Avant d'installer ou de connecter un système, arrêtez le moteur.

3. Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.

4. Pour empêcher un démarrage accidentel pendant l'entretien, débranchez le câble d'accumulateur à la borne négative.

5. N'approchez pas les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.

6. Réinstallez les capots ou les protecteurs et fermez les portes après des travaux d'entretien et avant de faire démarrer le moteur.

AVERTISSEMENT

DES ETINCELLES PEUVENT FAIRE EXPLOSER UN ACCUMULATEUR; L'ELECTROLYTE D'UN ACCUMU-LATEUR PEUT BRULER LA PEAU ET LES YEUX.

Les accumulateurs contiennent de l'électrolyte acide et dégagent des vapeurs explosives.

1. Portez toujours un écran facial en travaillant sur un accumu-lateur.

2. Arrêtez le moteur avant de connecter ou de déconnecter des câbles d'accumulateur.

3. N'utilisez que des outils anti-étincelles pour travailler sur un accumulateur.

4. N'utilisez pas une source de courant de soudage pour charger un accumulateur ou survolter momentanément un véhicule.

5. Utilisez la polarité correcte (+ et –) de l'accumulateur.

AVERTISSEMENT

LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT BRULANT SOUS PRESSION PEUVENT BRULER LA PEAU ET LES YEUX.

Le liquide de refroidissement d'un radiateur peut être brûlant et sous pression.

1. N'ôtez pas le bouchon de radiateur tant que le moteur n'est pas refroidi.

2. Mettez des gants et posez un torchon sur le bouchon pour l'ôter.
3. Laissez la pression s'échapper avant d'ôter complètement le bouchon.

1.05 PRINCIPAL SAFETY STANDARDS

Safety in Welding and Cutting, ANSI Standard Z49.1, from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA, 29CFR 1910, SAFETY AND HEALTH STANDARDS, obtainable from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWSF4.1, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.

National Electrical Code, NFPA Standard 70, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

SECTION 2: INTRODUCTION

2.01 How To Use This Manual

This Service Manual applies to just specification or part numbers listed on page i.

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING

A WARNING gives information regarding possible personal injury.

CAUTION

A CAUTION refers to possible equipment damage.

NOTE

A NOTE offers helpful information concerning certain operating procedures.

Additional copies of this manual may be purchased by contacting Thermal Arc at the address and phone number in your area listed in the inside back cover of this manual. Include the Service Manual number and equipment identification numbers.

Electronic copies of this manual can also be downloaded at no charge in Acrobat PDF format by going to the Thermal Arc web site listed below and clicking on the Literature Library link:
http://www.thermalarc.com

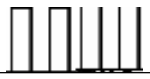
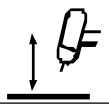
2.02 Equipment Identification

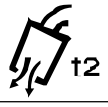
The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the control panel. In some cases, the nameplate may be attached to the rear panel. Equipment which does not have a control panel such as gun and cable assemblies is identified only by the specification or part number printed on the shipping container. Record these numbers on the bottom of page i for future reference.

ARCMASTER 160TS

2.04 Symbol Chart

Note that only some of these symbols will appear on your model.

A	**Amperage**
V	**Voltage**
Hz	**Hertz (frequency)**
SEC	**Seconds**
%	**Percent**
⎓	**DC (Direct Current)**
∿	**AC (Alternating Current**
	**Standard Function**
	**Slope Function**
	**Slope W/Repeat Function**
	**Spot Function**
	**Impulse Starting (High Frequency GTAW)**
	**Touch Start (Lift Start TIG circuit GTAW)**

	**STICK (Shielded Metal Arc SMAW)**
	**Pulse Current Function**
	**Spot Time (GTAW)**
	**Remote Control (Panel/Remote)**
	**Remote Function**
	**Arc Control (SMAW)**
	**Gas Post-Flow**
	**Gas Pre-Flow**
VRD	**Voltage Reduction Device Circuit**
	Negative
	**Positive**
	**Gas Input**
	**Gas Output**

2.05 Description

The Thermal Arc™ Model 160TS is a self contained single-phase DC arc welding power sources with Constant Current (CC) output characteristics. This unit is equipped with a Digital Volt/Amperage Meter, gas control valve, built in Sloper and Pulser, lift arc starter, and high-frequency arc starter for use with Gas Tungsten Arc Welding (GTAW), Gas Tungsten Arc Welding-Pulsed (GTAW-P) Gas Tungsten Arc Welding-Sloped (GTAW-S), and Shielded Metal Arc Welding (SMAW) processes. The power source is totally enclosed in an impact resistant, flame resistant and non-conductive plastic case.

Note

Volt-Ampere curves show the maximum Voltage and Amperage output capabilities of the welding power source. Curves of other settings will fall between the curves shown.

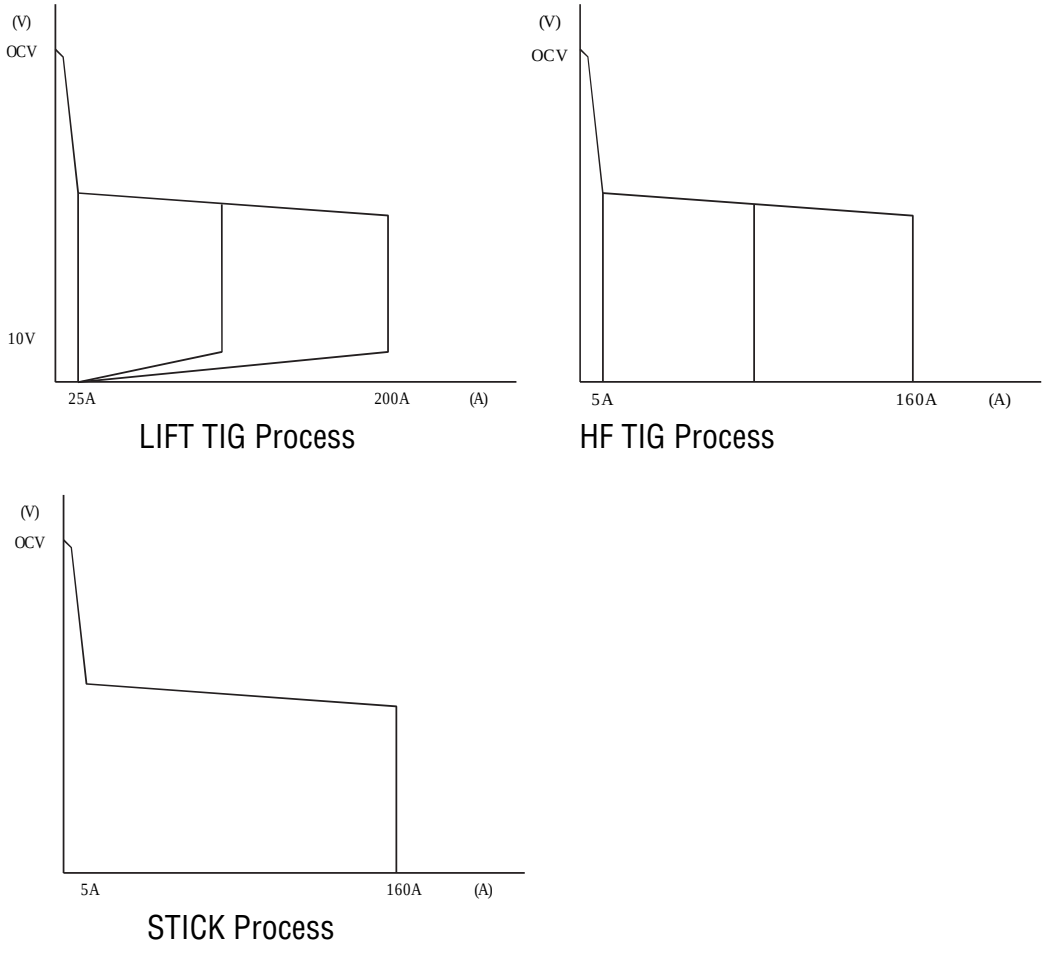


Figure 2-1: Model 160TS Volt-Ampere curve

2.06 Functional Block Diagrams

Figure 2-2 illustrates the functional block diagram of the 160TS-power supply.

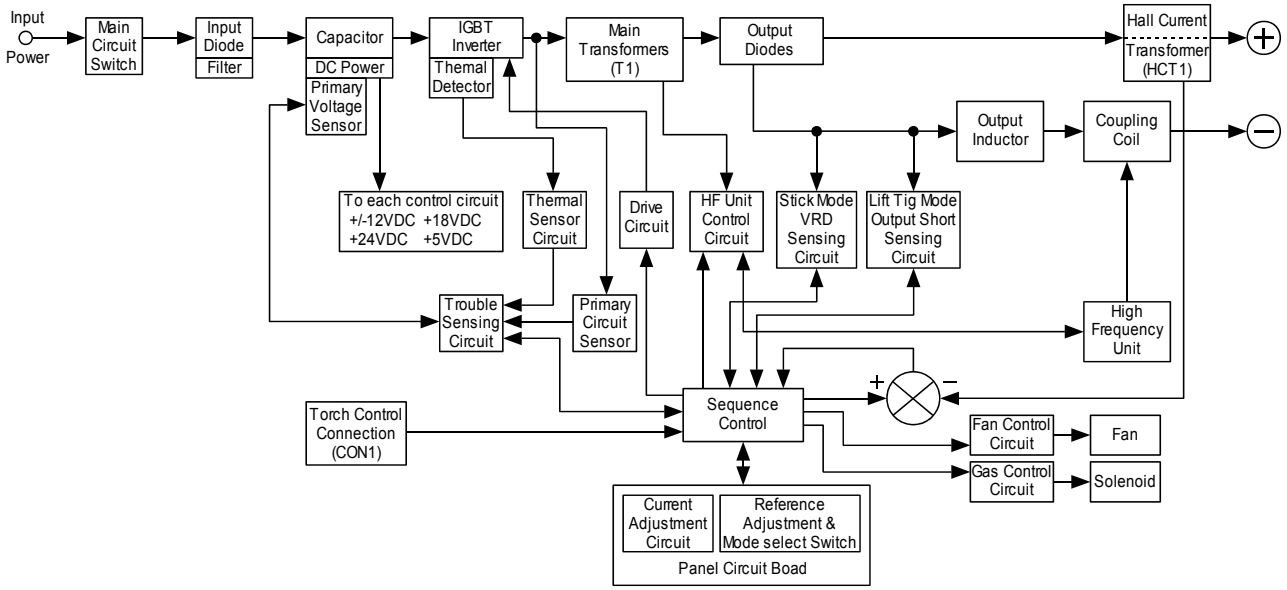


Figure 2-2: 160TS Model Functional Block Diagram

2.07 Transporting Methods

These units are equipped with a handle for carrying purposes.

WARNING

ELECTRIC SHOCK can kill.

☐ *DO NOT TOUCH live electrical parts.*

☐ *Disconnect input power conductors from de-energized supply line before moving the welding power source.*

WARNING

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

☐ *Lift unit with handle on top of case.*

☐ *Use handcart or similar device of adequate capacity.*

☐ *If using a fork lift vehicle, place and secure unit on a proper skid before transporting.*

SECTION 3: INSTALLATION

3.01 Environment

The ARC MASTER 160TS is designed for use in adverse environments.

Examples of environments with increased adverse conditions are:

a. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts;
b. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator, or
c. In wet or damp hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulation properties of accessories.

Environments with adverse conditions do not include places where electrically conductive parts are in the near vicinity of the operator, which can cause increased hazard, have been insulated.

3.02 Location

Be sure to locate the welder according to the following guidelines:

- In areas, free from moisture and dust.
- Ambient temperature between 0 degrees C to 40 degrees C.
- In areas, free from oil, steam and corrosive gases.
- In areas, not subjected to abnormal vibration or shock.
- In areas, not exposed to direct sunlight or rain.
- Place at a distance of 12" (304.79mm) or more from walls or similar boundaries that could restrict natural airflow for cooling.

WARNING

Thermal Arc advises that this equipment be electrically connected by a qualified electrician.

3.03 Electrical Input Connections

WARNING

ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power.

DO NOT TOUCH live electrical parts.

SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures. Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

3.04 Electrical Input Requirement

Operate the welding power source from a single-phase 50/60 Hz, AC power supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and any inspection required.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power supply whenever necessary to inspect or service the unit.

Note

This unit is equipped with a 250 VAC (NEMA 6-50P) plug molded on the two-conductor with earth power cable that is connected at the welding power source for single phase electrical input power. For direct wiring installation have a qualified person install according to all applicable codes and instructions for single and three phase electrical input power.

Do not connect an input (WHITE or BLACK) conductor to the ground terminal.

Do not connect the ground (GREEN) conductor to an input line terminal.

Refer to figure 3-1 and:

1. Connect end of ground (GREEN) conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. Connect ends of line 1 (BLACK) and line 2 (WHITE) input conductors to a de-energized line disconnect switch.
3. Use Table 1 and Table 2 as a guide to select line fuses for the disconnect switch.

Input Voltage	Fuse Size
115V	75 Amps
230V	75 Amps

Table 3-1: Electrical Input Connections

Note

Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Based on Article 630, National Electrical Code).

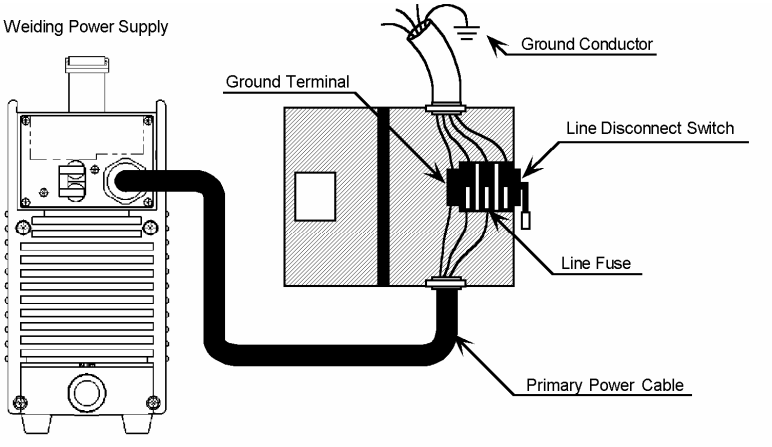


Figure 3-1: Electrical Input Connections

3.05 Input Power

Each unit incorporates an INRUSH circuit and input voltage sensing circuit. When the MAIN CIRCUIT SWITCH is turned on, the inrush circuit provides a pre-charging of the input capacitors. At this point, the Bus Voltages are checked and the welder is enabled after the input capacitors have charged to full operating voltage (approximately 5 seconds).

Note

Note the available input power. Damage to the welder could occur if 460VAC or higher is applied.

The following 208-230V Primary Current recommendations are required to obtain the maximum welding current and duty cycle from this welding equipment:

Model	Primary Supply Lead Size (Factory Fitted)	Minimum Primary Current Circuit Size (Vin/Amps)	Current & Duty Cycle	
			TIG	STICK
ARC MASTER 160TS	12/3 AWG minimum	115/23	85 @ 100%	-
		208/28	160 @ 35%	-
		230/25		-
		115/40	-	85 @ 100%
		208/44	-	160 @ 35%
		230/39	-	

Table 3-2: 208-230V Primary Current Circuit sizes to achieve maximum current

The ARC MASTER 160TS is designed for use with a generator as an input power source. Contact an accredited Thermal Arc service agent for the proper sizing and set-up recommendations of a generator power source system. As a general rule, depending on the type of generator used, the generator capacity should be twice the maximum rating of the welder.

3.06 High Frequency Introduction

The importance of correct installation of high frequency welding equipment cannot be over-emphasized. Interference due to high frequency initiated or stabilized arc is almost invariably traced to improper installation. The following information is intended as a guide for personnel installing high frequency welding machines.

WARNING: Explosives

The high frequency section of this machine has an output similar to a radio transmitter. The machine should NOT be used in the vicinity of blasting operations due to the danger of premature firing.

WARNING: Computers

It is also possible that operation close to computer installations may cause computer malfunction.

3.07 High Frequency Interference

Interference may be transmitted by a high frequency initiated or stabilized arc welding machine in the following ways:

1. **Direct Radiation:** Radiation from the machine can occur if the case is metal and is not properly grounded. It can occur through apertures such as open access panels. The shielding of the high frequency unit in the Power Source will prevent direct radiation if the equipment is properly grounded.
2. **Transmission via the Supply Lead:** Without adequate shielding and filtering, high frequency energy may be fed to the wiring within the installation (mains) by direct coupling. The energy is then transmitted by both radiation and conduction. Adequate shielding and filtering is provided in the Power Source.
3. **Radiation from Welding Leads:** Radiated interference from welding leads, although pronounced in the vicinity of the leads, diminishes rapidly with distance. Keeping leads as short as possible will minimize this type of interference. Looping and suspending of leads should be avoided where possible.
4. **Re-radiation from Unearthed Metallic Objects:** A major factor contributing to interference is re-radiation from unearthed metallic objects close to the welding leads. Effective grounding of such objects will prevent re-radiation in most cases.

3.08 Duty Cycle

The duty cycle of a welding power source is the percentage of a ten (10) minute period that it can be operated at a given output without causing overheating and damage to the unit. If the welding amperes decrease, the duty cycle increases. If the welding amperes are increased beyond the rated output, the duty cycle will decrease.

WARNING

Exceeding the duty cycle ratings will cause the thermal overload protection circuit to become energized and shut down the output until the unit has cooled to normal operating temperature.

CAUTION

Continually exceeding the duty cycle ratings can cause damage to the welding power source and will void the manufactures warranty.

NOTE

Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

3.09 Specifications

Parameter		160TS	
Rated Output Amperes Volts Duty Cycle		115VAC 230VAC 85 160 23 27 100% 35%	
Duty Cycle	TIG	160A / 17V @ 35% 230VAC 130A / 15V @ 60% 230VAC 100A / 14V @ 100% 230VAC 85A / 13V @ 100% 115VAC	
	STICK	160A / 27V @ 35% 230VAC 130A / 25V @ 60% 230VAC 100A / 24V @ 100% 230VAC 85A / 23V @ 100% 115VAC	
Output Current	TIG	1 – 160 (230V), 1 – 85 (115V)	
Range	STICK	1 – 160 (230V), 1 – 85 (115V)	
Open Circuit Voltage		65V	
Dimensions Width Height Length		 5.12” (130mm) 10.24” (260mm) 12.60” (320mm)	
Weight		17.63 lb. 8.0 kg	
Output @ Rated Load Output Amperes Output Volts Duty Cycle KVA KW		115V 230V 85A 160A 23V 27V 100% 35% 4.4 8.7 2.4 5.2	
Output @ No Load KVA KW		 0.5 0.3	
Input Volts Single Phase 208V 230V		Amperage Draw @ Rated Load 44 39	No Load Amps 2.2 1.6

Thermal Arc continuously strives to produce the best product possible and therefore reserves the right to change, improve or revise the specifications or design of this or any product without prior notice. Such updates or changes do not entitle the buyer of equipment previously sold or shipped to the corresponding changes, updates, improvements or replacement of such items.
The values specified in the table above are optimal values, your values may differ. Individual equipment may differ from the above specifications due to in part, but not exclusively, to any one or more of the following; variations or changes in manufactured components, installation location and conditions and local power grid supply conditions.

SECTION 4:
OPERATOR CONTROLS

4.01 ARC MASTER 160TS Controls

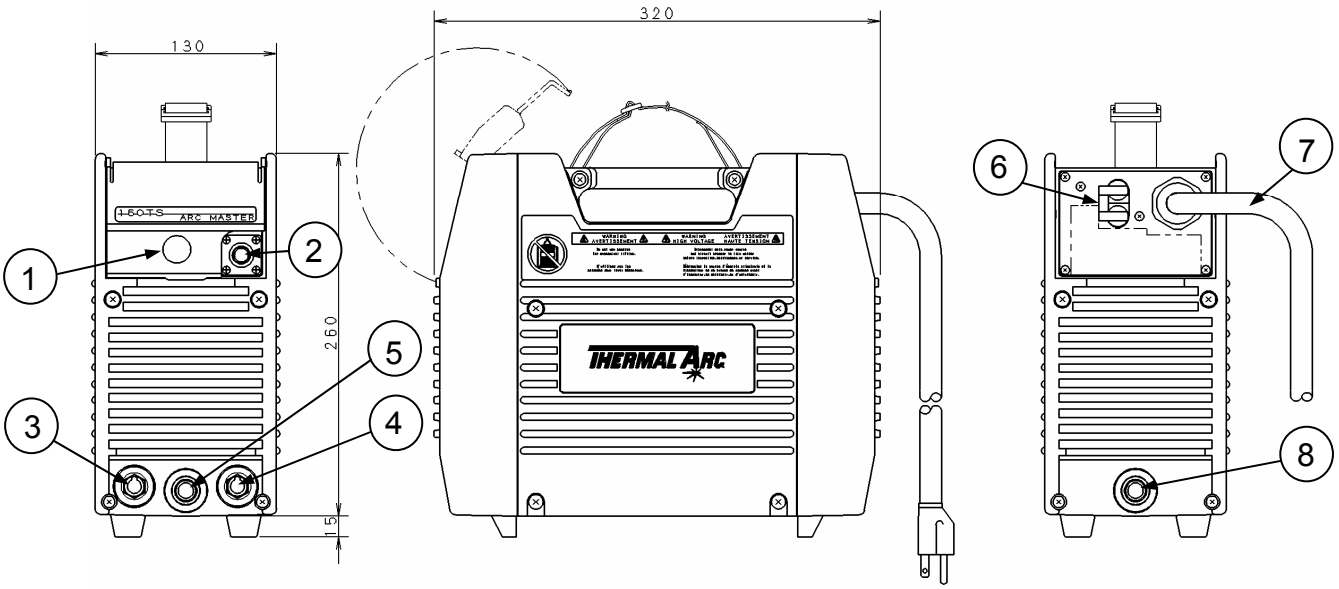


Figure 4-1: ARC MASTER 160TS Power Source

1. **Control Knob:** This control sets the selected weld parameter, rotating it clockwise increases the parameter that is indicated on the digital meter. Pushing the knob inward displays the actual welding voltage.

2. **Remote Control Socket:** The 8 pin Remote Control Socket is used to connect remote current control devices to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

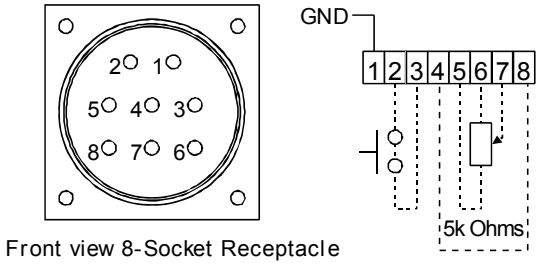


Figure 4-2: 8-Socket Receptacle

Socket Pin	Function
1	Earth (Ground)
2	Torch Switch Input (24V) to (connect pins 2 & 3 to turn on welding current)
3	Torch Switch Input (0V) to energize weld current (connect pins 2 & 3 to turn on welding current)
4	Connect pin 4 to pin 8 to instruct machine that a remote current control device is connected (12V DC supply)
5	5k ohm (maximum) connection to 5k ohm remote control potentiometer
6	Zero ohm (minimum) connection to 5k ohm remote control potentiometer
7	Wiper arm connection to 5k ohm remote control potentiometer
8	Connect pin 4 to pin 8 to instruct machine that a remote current control device is connected (0V)

Table 4-1: Socket Pin Functions

3. **Positive Terminal:** Welding current flows from the Power Source via heavy duty Dinse type terminal (Size 25mm Dinse). It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

4. **Negative Terminal:** Welding current flows from the Power Source via heavy duty Dinse type terminal (Size 25mm Dinse). It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal.

5. **Gas Outlet:** The Gas Outlet is a 5/8 18 UNF female gas fitting.

6. **ON/OFF Switch:** This switch connects the Primary supply voltage to the inverter when in the ON position. This enables the Power Supply.

WARNING

When the welder is connected to the Primary supply voltage, the internal electrical components may be at 240V potential with respect to earth.

7. **Input Cable:** The input cable connects the Primary supply voltage to the equipment.

8. **Gas Inlet:** The Gas Inlet is a 5/8 18 UNF female gas fitting.

4.02 Weld Process selection for 160TS

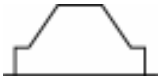
	Weld Mode			
Weld Process Selection	**STICK**	**HF TIG**	**LIFT TIG**	**Description**
 *STD*	Yes	Yes	Yes	2T operation in TIG Modes using remote devices to control contactor & current
 *SLOPE*	No	Yes	Yes	4T operation in TIG Modes with crater fill using a remote contactor device to control sequence.
 *REPEAT*	No	Yes	Yes	4T operation in TIG Modes with repeat operation and crater fill using a remote contactor device.
 *SPOT*	No	Yes	No	2T operation spot welding in HF TIG using a remote contactor device.
 *PULSE* ON/OFF	No	Yes	Yes	Pulse operation in TIG Modes

Table 4-2: Weld Process selection verses Weld Mode for 160TS

4.03 Weld Parameter Descriptions for ARC MASTER 160TS

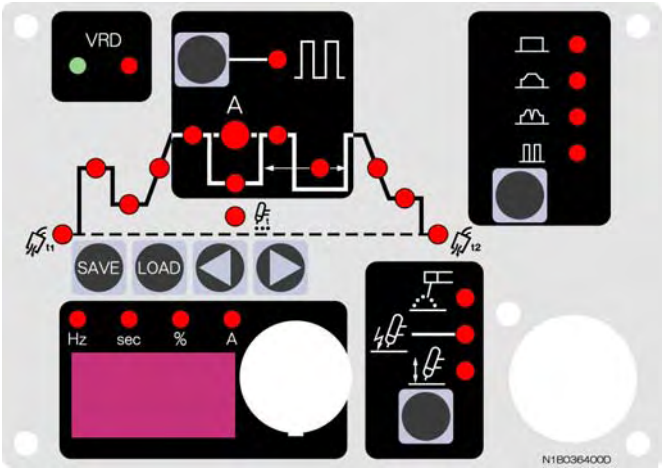


Figure 4-3: ARC MASTER 160TS Front Panel with Parameter Description

Parameter	Description
t1 *PRE-FLOW*	This parameter operates in TIG modes only and is used to provide gas to the weld zone prior to striking the arc, once the torch trigger switch has been pressed. This control is used to dramatically reduce weld porosity at the start of a weld.
HOT START	This parameter operates in all weld modes except Lift TIG mode and is used to heat up the weld zone in TIG modes or improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. It sets the peak start current on top of the *BASE (WELD)* current. e.g. *HOT START* current = 130 amps when *BASE (WELD)* = 100 amps & *HOT START* = 30 amps
INITIAL CUR.	This parameter operates in *SLOPE* or *REPEAT* (4T) TIG modes only and is used to set the start current for TIG. The Start Current remains on until the torch trigger switch is released after it has been depressed.
UP SLOPE	This parameter operates in TIG modes only and is used to set the time for the weld current to ramp up, after the torch trigger switch has been pressed then released, from INITIAL CUR to PEAK or BASE current
PEAK CUR.	This parameter sets the PEAK weld current when in *PULSE* mode
WELD	This parameter sets the TIG WELD current in *STD*, *SLOPE*, *REPEAT* and *SPOT* modes when *PULSE* is off. This parameter also sets the STICK weld current.
BASE (Background Current)	This parameter sets the Background current when in Pulse TIG mode.
SPOT TIME	This parameter sets the duration of the *SPOT TIME* in *HF TIG* mode only
PULSE WIDTH	This parameter sets the percentage on time of the *PULSE FREQUENCY* for PEAK weld current when the *PULSE* is on.
PULSE FREQ.	This parameter sets the *PULSE FREQUENCY* when the *PULSE* is on.

Parameter	Description
DOWN SLOPE	This parameter operates in TIG modes only and is used to set the time for the weld current to ramp down, after the torch trigger switch has been pressed, to *CRATER CUR.* This control is used to eliminate the crater that can form at the completion of a weld.
CRATER CUR.	This parameter operates in *SLOPE* or *REPEAT* (4T) TIG modes only and is used to set the finish current for TIG. The CRATER Current remains on until the torch trigger switch is released after it has been depressed.
POST-FLOW 	This parameter operates in TIG modes only and is used to adjust the post gas flow time once the arc has extinguished. This control is used to dramatically reduce oxidation of the tungsten electrode.
	The SAVE/LOAD buttons are used to save and retrieve a total number of 5 programs into the 160TS memory.

Table 4-3: Weld Parameter Descriptions for ARC MASTER 160TS

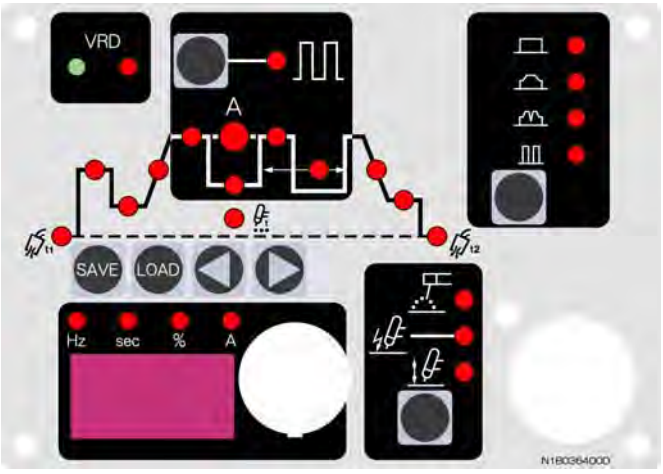


Figure 4-4: ARC MASTER 160TS Front Panel with Parameter Description

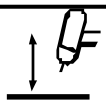
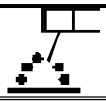
Parameter	Description
HOT START	This parameter operates in STICK weld mode and is used to improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. It sets the peak start current on top of the *(WELD)* current.
A	Weld Current (Amperage)- sets the STICK and TIG WELD current.
	ARC CONTROL - This parameter provides a suitable short circuit current in STICK welding to improve electrode sticking and arc stability.
	LIFT TIG mode of operation. A remote control device may be used for use during LIFT TIG operation. See section 4.01, section 2 "*Remote Control Socket*", for complete details of the remote device.
	STICK Mode of operation

Table 4-4: Weld Parameter Descriptions for ARC MASTER 160TS

4.04 Weld Parameters for ARC MASTER 160TS

				Weld Mode		
Weld Parameter	**Parameter Range**	**Factory Setting**	**Incremental Unit**	**STICK**	**HF TIG**	**LIFT TIG**
PRE-FLOW	0.0 to 1.0 sec	0 sec	0.1 sec	No	Yes	Yes
HOT START	0 to 70A	20A	1A	Yes	Yes	No
INITIAL CUR.	1 to 160A	30A	1A	No	Yes	Yes
UP SLOPE	0 to 15 sec	1 sec	0.1 sec	No	Yes	Yes
PEAK CUR.	1 to 160A	120A	1A	No	Yes	Yes
WELD CUR	1 to 160A 230V 1 to 85A 115V	80A 80A	1A 1A	Yes Yes	Yes Yes	Yes Yes
SPOT TIME	0.5 to 5.0 sec	2 sec	0.1 sec	No	Yes	No
PULSE WIDTH	15 to 80%	50%	1%	No	Yes	Yes
PULSE FREQ.	0.5 to 500Hz	100.0Hz	See Table 4-6	No	Yes	Yes
DOWN SLOPE	0 to 25 sec	3 sec	0.1 sec	No	Yes	Yes
CRATER CUR.	1 to 160A	30A	1A	No	Yes	Yes
POST-FLOW	0.0 to 60 sec	10 sec	0.1 sec	No	Yes	Yes

Table 4-5: Weld Parameters for ARC MASTER 160TS

***PULSE FREQ.* Range**	**Incremental Unit**
0.5 to 20Hz	0.1Hz
20 to 100Hz	1Hz
100 to 500Hz	5Hz

Table 4-6: *PULSE FREQ.* Range and Incremental Units

4.05 Power Source Features

Feature	Description
New Digital Control	• Almost all welding parameters are adjustable
Touch Panel Switches	• Touch switches eliminate mechanical damage
Front Control Cover	• Protects front panel controls
Digital Meter	• Displays selected weld parameter value • Displays weld current when welding • Displays weld current for 20 seconds after weld has been completed • A selected weld parameter value can be adjusted at any time even while welding
ON/OFF switch	• Primary voltage Supply ON/OFF switch located on rear panel
Save/Load Function	• A total number of 5 programs can be saved into the 160TS memory ***SAVE* the Current Weld Parameters into Memory** • Press the *SAVE* button • Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter • After selecting the desired memory location (ie 1 to 5), press the right scroll button and the machine will give a beep to verify the weld parameters from the control panel are saved. ***LOAD* (retrieve) a Program to Control Panel** • Press the *LOAD* button • Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter • After selecting the desired memory location (ie 1 to 5), press the right scroll button and the machine will give a beep to verify the weld parameters from the weld parameters are loaded.
Voltage Reduction Device (VRD)	Reduces the OCV when the power supply is not in use. Eliminates the need for add on voltage reducers and has no effect on arc starting. • VRD fully complies to IEC 60974-1 • When Stick mode is selected the green VRD light is ON when not welding and red when welding. • When in TIG modes VRD is off.
Control Knob	• For the selected weld parameter, rotating the knob clockwise increases the parameter • Rotating the knob counter-clockwise decreases the parameter • A selected weld parameter value can be adjusted at any time even while welding • Pushing the knob in displays actual arc voltage.
Self Diagnosis Using Error Codes	• An error code is displayed on the *Digital Meter* when a problem occurs with Primary supply voltage or internal component problems. Refer to troubleshooting guide.

Table 4-7: Power Source Features

SECTION 5:
SET-UP FOR SMAW (STICK) AND GTAW (TIG)

Conventional operating procedures apply when using the Welding Power Source, i.e. connect work lead directly to work piece and electrode lead is used to hold electrode. Wide safety margins provided by the coil design ensure that the Welding Power Source will withstand short-term overload without adverse effects. The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrodes, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide, then finally adjust the current setting to suit the application.

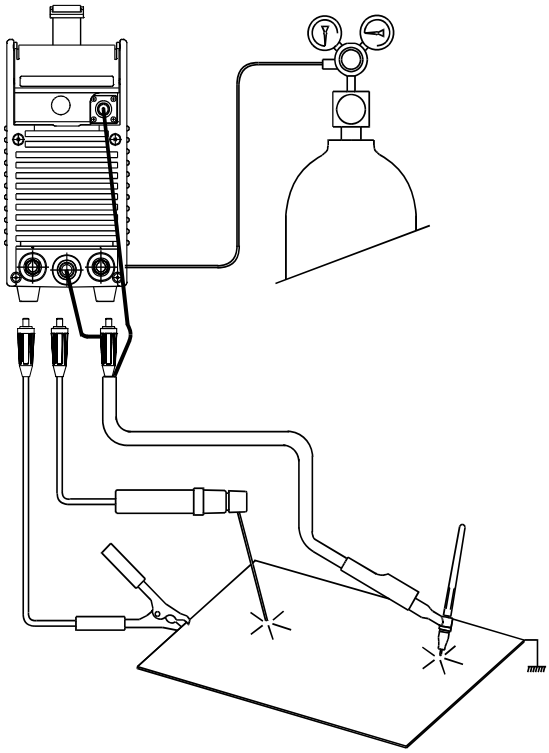


Figure 6-1: 160TS Set-up

WARNING

Before connecting the work clamp to the work and inserting the electrode in the electrode holder make sure the Primary power supply is switched off.

CAUTION

Remove any packaging material prior to use. Do not block the air vents at the front or rear or sides of the Welding Power Source.

CAUTION

DO NOT change the Weld Mode or Weld Process Mode until after POST-FLOW time has finished.

SECTION 6:
SEQUENCE OF OPERATION

Note

Scroll Buttons are used to select the parameters to be set. The LED's show which function is being adjusted on the weld sequence graph. Refer to the Symbols Table located in the front of the manual for Symbol descriptions.

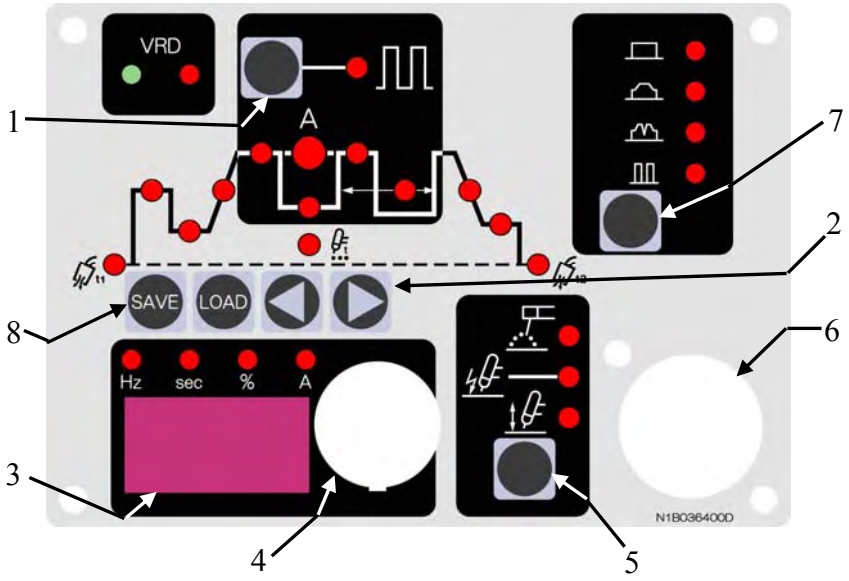


Figure 6-1: 160TS Front Panel

1. Pulse function – Pressing this button enables the TIG current pulse functions.
2. Scroll Buttons – used to select the parameter to be set. The LED's show which function is being adjusted on the weld sequence graph.
3. Digital LED display – Welding amperage and parameter values are displayed in this window. Internal warnings such as over temperature, primary input current too high applied are signaled to the operator by a warning sound and error message on the screen.
4. Control knob – allows the operator to adjust the output amperage within the entire range of the power source, also used to set each parameter value. Pushing the knob inward displays the actual welding voltage.
5. Process Button - This button selects between STICK, Lift or HF TIG*mode.
6. 8 pin remote control receptacle for connecting remote device.
7. TIG Mode Functions – Pressing this button scrolls through the output TIG function modes (Standard, Slope, Slope w/repeat, Spot).
8. Save/Load Button – by using the Save & Load buttons the operator can easily save up to 5 welding parameter program.

ARCMASTER 160TS

6.01 Stick Welding

- ☐ Connect work lead to negative terminal
- ☐ Connect electrode lead to positive terminal
- ☐ Switch machine on
- ☐ Set weld current
- ☐ Connect remote control device if required

Use the Scroll Buttons to move to the parameter that needs to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

- ☐ Set HOT START
- ☐ Set *WELD* current

Commence welding

6.02 *HF TIG & Lift TIG Welding*

- ☐ Connect work lead to positive terminal
- ☐ Connect TIG torch to negative terminal
- ☐ Switch machine on
- ☐ Set *WELD* current.
- ☐ Connect remote control device. A remote control device is required for use during LIFT TIG and HF TIG operation. See section 4.1, section 2 "*Remote Control Socket*", for complete details of the remote device.

Use the Scroll Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

- ☐ Set *PRE-FLOW* time
- ☐ Set *HOT START* current
- ☐ Set *POST-FLOW* time
- ☐ Set *WELD* current
- ☐ Set *POST-FLOW* time

Slope Mode Parameters if required

- ☐ Set *INTIAL CUR* current
- ☐ Set *UP SLOPE* time
- ☐ Set (WELD) *PEAK CUR* current
- ☐ Set *BASE* current
- ☐ Set *DOWN SLOPE* time
- ☐ Set *CRATER CUR* current

Pulse Mode parameters if required

- ☐ Set PULSE WIDTH % for PEAK CURRENT
- ☐ Set PEAK CURRENT
- ☐ Set PULSE FREQ

Commence welding

6.03 Slope Mode Sequence

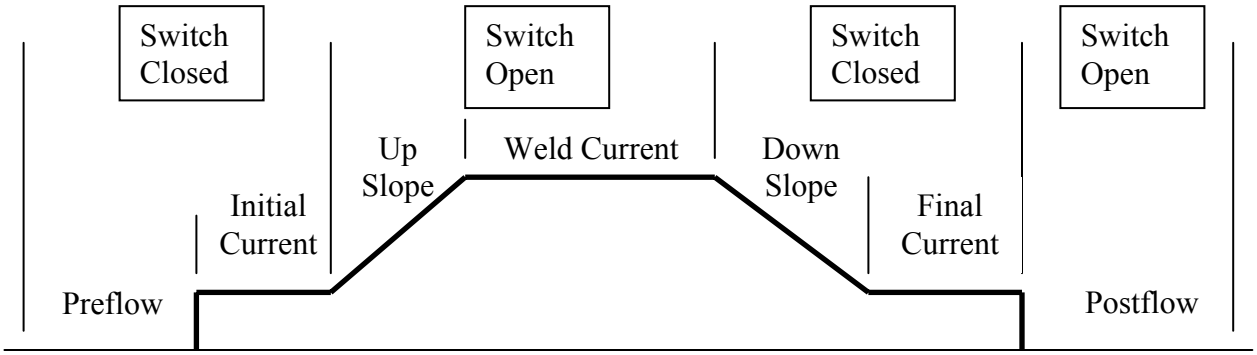


Figure 6-3: Slope Mode Sequence

1. To start the Slope sequence, close the remote switch contacts. Once the welding arc is established the Power Source will maintain the initial current setting as long as the remote switch contacts are closed.

   a. In the HF TIG mode, after Preflow time, High Frequency is present at the torch. When the torch is positioned close to the work the welding current will transfer to the work and establish the arc at the initial current setting.

   b. In the Lift TIG mode, after Preflow time, Lift Start current is present at the torch. When the electrode is touched to the work and lifted off, the welding arc is established at the initial current setting.

2. Open Remote Switch – current increases to weld current. Once welding arc has reached weld current the power source will maintain weld current as long as the remote switch contacts are open.

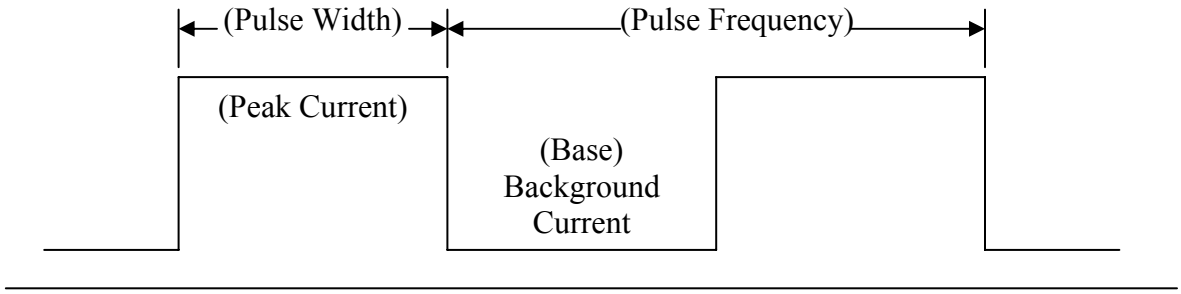
3. Close Remote Switch – Welding current decreases to final current setting. Once final welding current is reached the power source will maintain final current setting as long as the remote switch contacts are closed.

4. Open Remote Switch – Welding arc stops and post flow begins.

6.04 Slope Mode with repeat sequence

The repeat function is operated during the down slope cycle of the Slope Sequence and is active through the down slope period only. During the down slope period by opening the Remote Switch contacts the current will increase back to weld current. Within the Down Slope period the repeat function can be operated as many times as desired. To continue the slope cycle and end the slope sequence, close the remote switch contacts and allow the weld current to reach the final current setting. Once the final current setting is reached, opening the Remote Switch again will turn off the welding arc and post flow begins.

6.05 Pulse Controls



The Pulse controls are used primarily to control heat input. Pulse offers a number of advantages as follows:

1) Control puddle – size and fluidity (especially out of position).
2) Increase penetration
3) Travel speed control
4) Better consistent quality
5) Decreased distortion on lighter or thinner materials.

Pulse-current provides a system in which the welding current continuously changes between two levels. During the periods of Peak current, heating and fusion takes place, and during the background (base) current periods, cooling and solidification take place. Pulse Width is the time in one cycle the current remains at the peak current setting. Pulse Frequency, measured in Hertz, is the number of cycles per second the current travels between peak and background current settings. It is as if the foot rheostat were moved up and down to increase and decrease the welding current on a regular basis. The faster you move the foot rheostat up and down the faster the frequency.

SECTION 7:
ROUTINE MAINTENANCE

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.

WARNING

Disconnect primary power at the source before opening the enclosure. Wait at least two minutes before opening the enclosure to allow the primary capacitors to discharge.

To clean the unit, open the enclosure (please refer to Section 11.01.1, Opening the Enclosure) and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean, if necessary; with solvents that are recommended for cleaning electrical apparatus.

CAUTION

Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

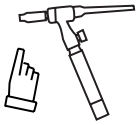
Warning!
Disconnect input power before maintaining.

Maintain more often if used under severe conditions

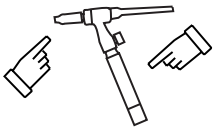
Each Use

Visual check of regulator and pressure

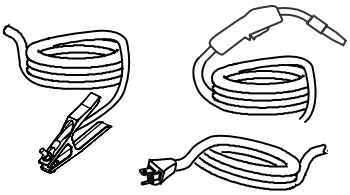
Visual check of torch Consumable parts



Weekly



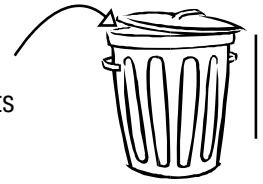
Visually inspect the torch body and consumables



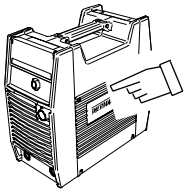
Visually inspect the cables and leads. Replace as needed

3 Months

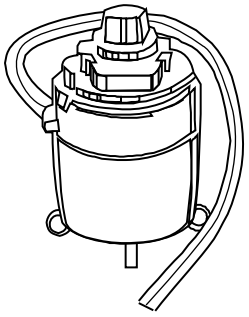
Replace all broken parts



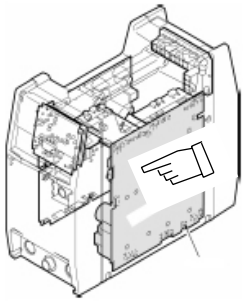
Clean exterior of power supply



6 Months



Bring the unit to an authorized Thermal Arc Service Center to remove any accumulated dirt and dust from the interior. This may need to be done more frequently under exceptionally dirty conditions.



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SECTION 8:
BASIC TROUBLESHOOTING

WARNING

There are extremely dangerous voltages and power levels present inside this product. Do not attempt to open or repair unless you are an Accredited Thermal Arc Service Agent and you have had training in power measurements and troubleshooting techniques.

If major complex subassemblies are faulty, then the Welding Power Source must be returned to an Accredited Thermal Arc Service Agent for repair.
The basic level of troubleshooting is that which can be performed without special equipment or knowledge.

8.01 TIG Welding Problems

Weld quality is dependent on the selection of the correct consumables, maintenance of equipment and proper welding technique.

	Description	Possible Cause	Remedy
1	Excessive bead build-up or poor penetration or poor fusion at edges of weld.	Welding current is too low.	Increase weld current and/or faulty joint preparation.
2	Weld bead too wide and flat or undercut at edges of weld or excessive burn through.	Welding current is too high.	Decrease weld current.
3	Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast.	Reduce travel speed.
4	Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too slow.	Increase travel speed.

Table 8-1: TIG Welding Problems

Description	Possible Cause	Remedy
5 Uneven leg length in fillet joint.	Wrong placement of filler rod.	Re-position filler rod.
6 Electrode melts when arc is struck.	A Electrode is connected to the '+' terminal. B *WAVE BALANCE* is greater than 50%.	A Connect the electrode to the '–' terminal. B Reduced *WAVE BALANCE* to below 50% or increase the electrode size.
7 Dirty weld pool.	A Electrode contaminated through contact with work piece or filler rod material. B Gas contaminated with air.	A Clean the electrode by grinding off the contaminates. B Check gas lines for cuts and loose fitting or change gas cylinder.
8 Electrode melts or oxidizes when an arc is struck.	A No gas flowing to welding region. B Torch is clogged with dust. C Gas hose is cut. D Gas passage contains impurities. E Gas regulator turned off. F Torch valve is turned off. G The electrode is too small for the welding current. H *WAVE BALANCE* is set above 50%.	A Check the gas lines for kinks or breaks and gas cylinder contents. B Clean torch. C Replace gas hose. D Disconnect gas hose from torch then raise gas pressure and blow out impurities. E Turn on. F Turn on. G Increase electrode diameter or reduce the welding current. H Reduced *WAVE BALANCE* to below 50% or increase the electrode size.
9 Poor weld finish.	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
10 Arc flutters during TIG welding.	A Tungsten electrode is too large for the welding current. B Absence of oxides in the weld pool.	A Select the right size electrode. Refer to Basic TIG Welding guide. B Refer Basic TIG Welding Guide for ways to reduce arc flutter.

Table 8-1 (continued): TIG Welding Problems

Description	Possible Cause	Remedy
11 Welding arc can not be established.	A Work clamp is not connected to the work piece or the work/torch leads are not connected to the right welding terminals.	A Connect the work clamp to the work piece or connect the work/torch leads to the right welding terminals.
	B Torch lead is disconnected.	B Connect it to the '–' terminal.
	C Gas flow incorrectly set, cylinder empty or the torch valve is off.	C Select the right flow rate, change cylinders or turn torch valve on.
12 Arc start is not smooth.	A Tungsten electrode is too large for the welding current.	A Select the right size electrode. Refer to Basic TIG Welding Guide.
	B The wrong electrode is being used for the welding job.	B Select the right electrode type. Refer to Basic TIG Welding Guide.
	C Gas flow rate is too high.	C Select the correct rate for the welding job. Refer to Basic TIG Welding Guide.
	D Incorrect shielding gas is being used.	D Select the right shielding gas. Refer to Basic TIG Welding Guide.
	E Poor work clamp connection to work piece.	E Improve connection to work piece.

Table 8-1 (continued): TIG Welding Problems

8.02 Stick Welding Problems

Description	Possible Cause	Remedy
1 Gas pockets or voids in weld metal (Porosity).	A Electrodes are damp. B Welding current is too high. C Surface impurities such as oil, grease, paint, etc.	A Dry electrodes before use. B Reduce welding current. C Clean joint before welding.
2 Crack occurring in weld metal soon after solidification commences.	A Rigidity of joint. B Insufficient throat thickness. C Cooling rate is too high.	A Redesign to relieve weld joint of severe stresses or use crack resistance electrodes. B Travel slightly slower to allow greater build up in throat. C Preheat plate and cool slowly.
3 A gap is left by failure of the weld metal to fill the root of the weld.	A Welding current is too low. B Electrode too large for joint. C Insufficient gap. D Incorrect sequence.	A Increase welding current B Use smaller diameter electrode. C Allow wider gap. D Use correct build-up sequence.

Table 8-2: STICK Welding Problems

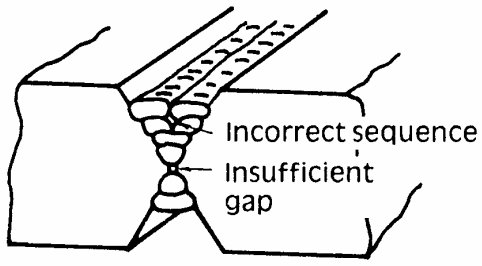


Figure 8-1: Example of insufficient gap or incorrect sequence

4	Portions of the weld run do not fuse to the surface of the metal or edge of the joint.	A Small electrodes used on heavy cold plate.	A Use larger electrodes and pre-heat the plate.
		B Welding current is too low.	B Increase welding current.
		C Wrong electrode angle.	C Adjust angle so the welding arc is directed more into the base metal.
		D Travel speed of electrode is too high.	D Reduce travel speed of electrode.
		E Scale or dirt on joint surface.	E Clean surface before welding.

Table 8-2 (continued): STICK Welding Problems

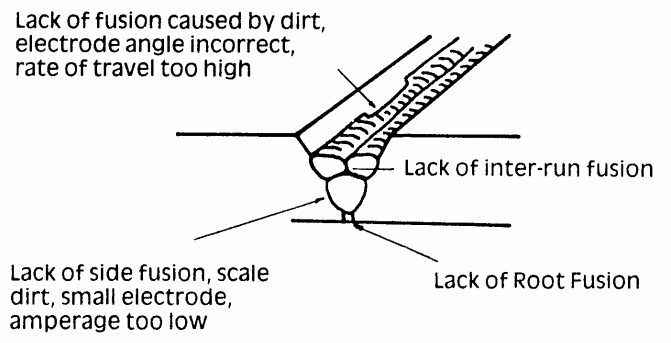


Figure 8-2: Example of lack of fusion

5	Non-metallic particles are trapped in the weld metal (slag inclusion).	A	Non-metallic particles may be trapped in undercut from previous run.
				A	If bad undercut is present, clean slag out and cover with a run from a smaller diameter electrode.
		B	Joint preparation too restricted.	B	Allow for adequate penetration and room for cleaning out the slag.
		C	Irregular deposits allow slag to be trapped.	C	If very bad, chip or grind out irregularities.
		D	Lack of penetration with slag trapped beneath weld bead.	D	Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from corners.
		E	Rust or mill scale is preventing full fusion.	E	Clean joint before welding.
		F	Wrong electrode for position in which welding is done.	F	Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.

Table 8-2 (continued): STICK Welding Problems

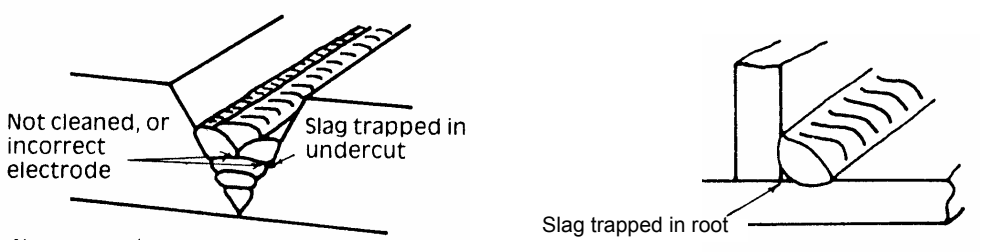


Figure 8-3: Examples of slag inclusion

8.03 Power Source Problems

Description	Possible Cause	Remedy
1 The welding arc cannot be established.	A The Primary supply voltage has not been switched ON. B The Welding Power Source switch is switched OFF. C Loose connections internally.	A Switch ON the Primary supply voltage. B Switch ON the Welding Power Source. C Have an Accredited Thermal Arc Service Agent repair the connection
2 Maximum output welding current can not be achieved with nominal Mains supply voltage.	Defective control circuit.	Have an Accredited Thermal Arc Service Agent repair the connection
3 Welding current reduces when welding.	A Loose welding cable connections. B Incorrect welding cable size. C Improper input connections. D Poor electrode condition. E Wrong welding polarity.	A Tighten all welding cable connections. B Use proper size and type of cable. C Refer to Section 2.05 Electrical Input Requirements. D Replace electrode. E Verify output torch connections.
4 No gas flow when the torch trigger switch is depressed.	A Gas hose is cut. B Gas passage contains impurities. C Gas regulator turned off. D Torch trigger switch lead is disconnected or switch/cable is faulty.	A Replace gas hose. B Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities. C Turn gas regulator on. D Reconnect lead or repair faulty switch/cable.

Table 8-3: Power Source Problems

Description	Possible Cause	Remedy
5 Gas flow won't shut off.	A Weld Mode (*STD*, *SLOPE*, *REPEAT* or *SPOT*) was changed before *POST-FLOW* gas time had finished.	A Strike an arc to complete the weld cycle. OR Switch machine off then on to reset solenoid valve sequence.
	B Gas valve is faulty.	B Have an Accredited Thermal Arc Service Agent repair or replace the gas valve
	C Gas valve jammed open.	C Have an Accredited Thermal Arc Service Agent repair or replace the gas valve
	D *POST-FLOW* control is set to 60 sec.	D Reduce *POST-FLOW* time.
6 The TIG electrode has been contaminated due to the gas flow shutting off before the programmed *POST-FLOW* time has elapsed.	The Weld Process Mode (STICK, HF TIG or LIFT TIG) was changed before *POST-FLOW* gas time had finished.	Do not change Weld Process Mode before the *POST-FLOW* gas time had finished.

Table 8-3 (continued): Power Source Problems

SECTION 9:
VOLTAGE REDUCTION DEVICE (VRD)

9.01 VRD Specification

Description	ARC MASTER 160TS	Notes
VRD Open Circuit Voltage	15.3 to 19.8V	Open circuit voltage between welding terminals.
VRD Resistance	148 to 193 ohms	The required resistance between welding terminals to turn ON the welding power.
VRD Turn OFF Time	0.2 to 0.3 seconds	The time taken to turn OFF the welding power once the welding current has stopped.

Table 9-1: VRD Specification

9.02 VRD Maintenance

Routine inspection and testing (power source):
An inspection of the power source should be carried out
a. For transportable equipment, at least once every 3 months; and
b. For fixed equipment, at least once every 12 months.
The owners of the equipment shall keep a suitable record of the periodic tests.

Note

A transportable power source is any equipment that is not permanently connected and fixed in the position in which it is operated.

In addition to the above tests and specifically in relation to the VRD fitted to this machine, the following periodic tests should also be conducted by an accredited Thermal Arc service agent.

Description	IEC 60974-1 Requirements
VRD Open Circuit Voltage	Less than 20V; at Vin=230V
VRD Turn ON Resistance	Less than 200 ohms
VRD Turn OFF Time	Less than 0.3 seconds

Table 9-2: Periodic Tests

If this equipment is used in a location or an environment with a high risk of electrocution then the above tests should be carried out prior to entering this location.

The VRD test is shown below:

1) In STICK welding mode, mark and then turn potentiometer VR1 on PCB4 (WK-5449) fully clockwise and turn on the electric shock protector function (Voltage-Reduction-Device, VRD).

2) Verify the no-load voltage (OCV) using a DC voltmeter. (The capability of the voltmeter should be more than 100VDC.)

3) The normal no-load voltage is approximately 18V.

4) In STICK welding mode, mark and then turn potentiometer VR1 on PCB4 (WK-5449) fully clockwise and turn off the VRD.

5) Contactor function is put into the state of "ON" by pushing the Function button. Refer to section 6.

WARNING

Electric shock hazard. The unit will generate OCV (Open Circuit Voltage) immediately when contactor function is put into the state of "ON" by pushing the Function button and enabling STICK mode.

7) Verify the no-load voltage (OCV) using a DC voltmeter. (The capability of the voltmeter should be more than 100VDC.)

8) The normal no-load voltage is approximately 65V.

9.03 Switching VRD On/Off

Switch the machine Off.

A) Remove the clear plastic cover from the control panel (see Figure 9-1).

- ☐ Lift up the cover so it rests on the top of the unit.
- ☐ Place a small flat bladed screw driver between the cover hinge on the front panel.
- ☐ Gently lift the cover hinge out of the front cover mounting hole.
- ☐ Remove the control's clear plastic cover.

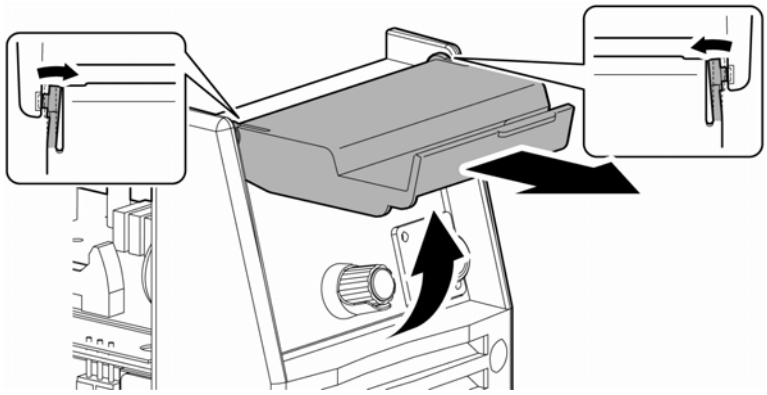


Figure 9-1: VRD ON/OFF Step A

B) Remove four mounting screws from the control panel (see Figure 9-2).

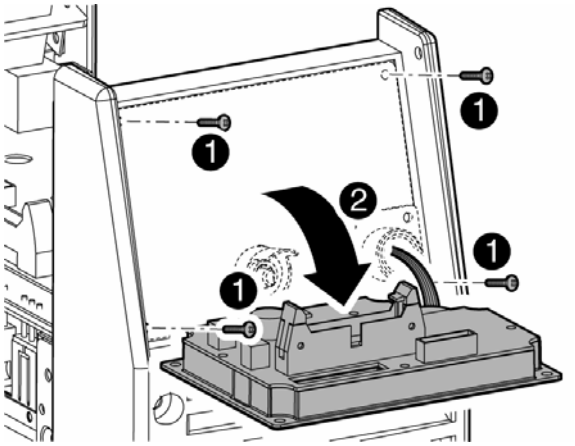


Figure 9-2: VRD ON/OFF Step B,C

C) Access the VRD control by gently prying back the front panel controls to reveal the VRD on/off potentiometer (see Figure 9-3).

CAUTION

Do not pull back the front panel with excessive force as this will unplug control PCB. Plugging the control PCB back into the front panel controls can only be achieved by removing the side covers.

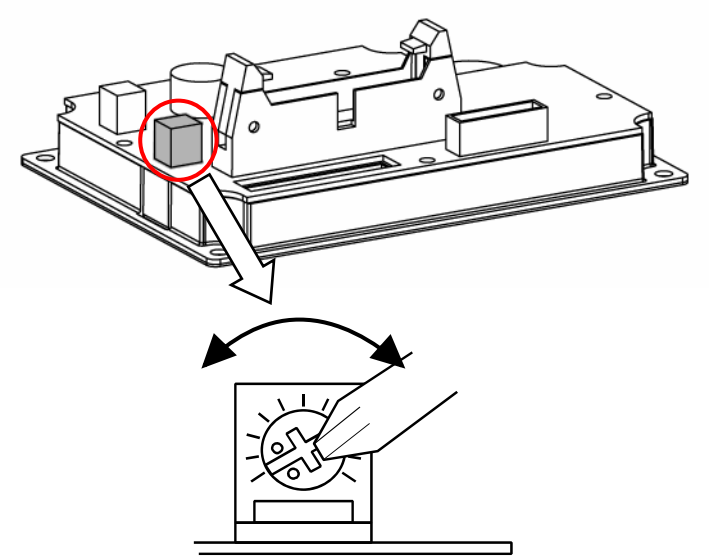


Figure 9-3: VRD ON/OFF Step D

D) Turning the VRD ON/OFF (see Figure 9-3).

- ☐ To turn VRD ON: rotate the trim potentiometer (VR1) on the display PCB fully clockwise. When VRD is turned ON check that it operates as per VRD Specifications on page 9.01.
- ☐ To turn VRD OFF: rotate the trim potentiometer (VR1) on the display PCB fully counter clockwise.

WARNING

The VRD ON/OFF trim potentiometer MUST ONLY be positioned fully clockwise OR fully counter clockwise as the VRD function will be unknown for every other position.

SECTION 10:
POWER SOURCE ERROR CODE

	Description	Possible Cause	Remedy	Remarks
1	E01 error code displayed Temperature sensor TH1 (protects IGBTs) is greater than 80ºC for about 1 second.	A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked.	A Let Power Source cool down then keep within its duty cycle. B Have an Accredited Thermal Arc Service Agent investigate. C Unblock vents then let Power Source cool down.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E01 resets when TH1 decreases to 70ºC for about 30 seconds.
2	E02 error code displayed Temperature sensor TH2 (protects secondary diodes) is greater than 80ºC for about 1 second.	A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked.	A Let Power Source cool down then keep within its duty cycle. B Have an Accredited Thermal Arc Service C Agent investigate Unblock vents then let Power Source cool down.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E02 resets when TH2 decreases to 70ºC for about 30 seconds.
3	E03 error code displayed Primary Transformer current too high.	A Primary Transformer current is too high because welding arc is too long. B Mains supply voltage is more than 10% below nominal voltage .	A Reduce length of welding arc. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check for low Mains voltage.	Weld current ceases. Buzzer sounds constantly. Switch machine off then on to reset E03 error.

Table 10-3: Power Source Error Codes

Description	Possible Cause	Remedy	Remarks
4 <u>E94 error code displayed</u> Temperature sensor TH1 for IGBTs or sensor TH2 for secondary diodes are open circuit.	The Welding Power Source's temperature sensors have malfunctioned.	Have an Accredited Thermal Arc Service Agent check or replace the temperature sensors	Weld current ceases. Buzzer sounds constantly. Switch machine off.
5 <u>E99 error code displayed</u> Mains supply (input) voltage has been turned off but control circuit has power from the primary capacitors.	A Main on/off switch on machine has been turned off B Mains supply (input) voltage has been turned off.	A Turn on/off switch on. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage and fuses.	Weld current ceases. Buzzer sounds constantly. Must switch machine off then on to reset E99 error.

Table 10-3 (continued): Power Source Error Codes

SECTION 11:
ADVANCED TROUBLE SHOOTING

If you are here, all of the troubleshooting suggestions in Section 8 Basic Troubleshooting have either failed to resolve the faulty operation or have indicated that one or more of the subsystems within the power supply are defective. This section provides the information needed to take live measurements on the various subsystems within the power supply, and replace those subsystems that prove faulty.

CAUTION

Troubleshooting and repairing this unit is a process, which should be undertaken only by those familiar with high voltage/high power electronic equipment.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have training in power electronics, measurement and troubleshooting techniques.

Under no circumstances are field repairs to be attempted on printed circuit boards or other subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty. If a subassembly is found to be defective by executing any of the procedures in this Service Manual, the subassembly should be replaced with a new one. The faulty subassembly should then be returned to Thermal Arc through established procedures.

WARNING

Disconnect primary power at the source before disassembling the power supply. Frequently review the " Principle Safety Standards" in section 1.02. Be sure the operator is equipped with proper gloves, clothing and eye and ear protection. Make sure no part of the operator's body comes into contact with the work piece or any internal components while the unit is activated.

Under no circumstances are field repairs to be attempted on printed circuit boards or other subassemblies of this unit. Evidence of unauthorizedrepairs will void the factory warranty. If a subassembly is found to be defective by executing any of the procedures in this Service Manual, the subassembly should be replaced with a new one. Thefaulty subassembly should then be returned toThermal Arc through established procedures.

11.01 System-Level Fault Isolation

If none of the suggestions provided in Section 8 have solved the problem or corrected the faulty operation, the next step is to isolate one or more of the internal subassemblies that may be defective.

CAUTION

Perform all steps in each procedure, in sequence. Skipping portions of procedures, or performing steps out of sequence can result in damage to the unit, and possible injury, or worse, to the operator.

1. Opening the Enclosure
   a) Verify that the switch on the power supply and the switch on the switchboard (distribution panel) are all OFF.

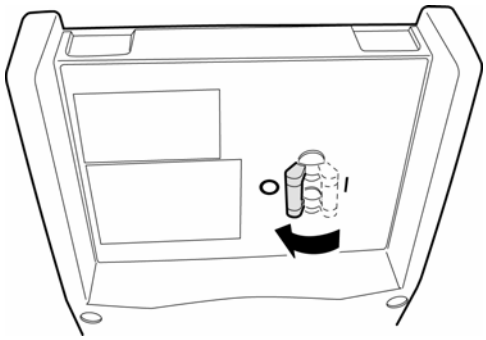


Figure 11-1 Switch OFF

CAUTION

The capacitors inside the power supply will slowly discharged after you turn off the switch of the power supply or the switch at the breaker box (distribution panel). Wait at least 5 minutes for the discharge to complete.

   b) Remove all screws and nuts on the Side Panel.

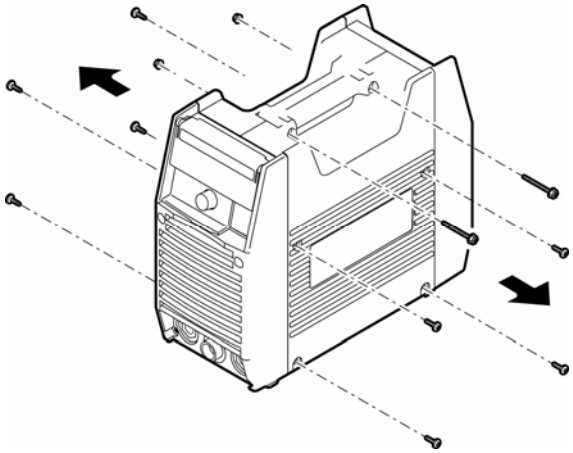


Figure 11-2 Remove screws

c) Loosen the screws on the Front Panel and the Rear Panel by turning them approximately two turns CCW.

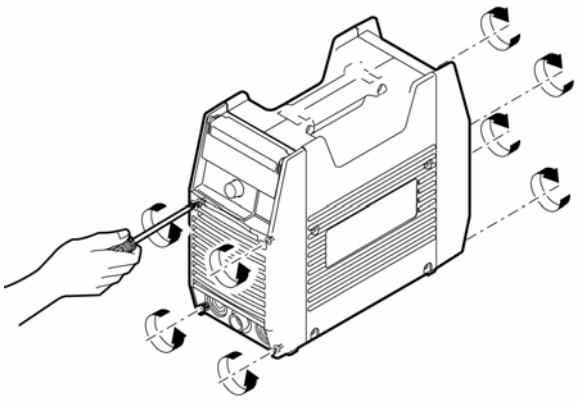


Figure 11-3 Loosen screws

Note

DO NOT remove the screws completely.

d) Pull the front panel slightly forward and pull the rear panel slightly backward. The interlocking hooks of the side case covers can now be disengaged from the Front Panel and Rear Panel

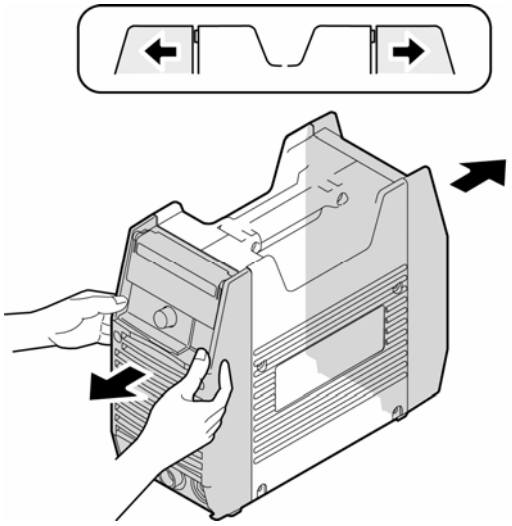


Figure 11-4 Loosen Front Panel and Rear Panel

e) Remove the Side Panel.

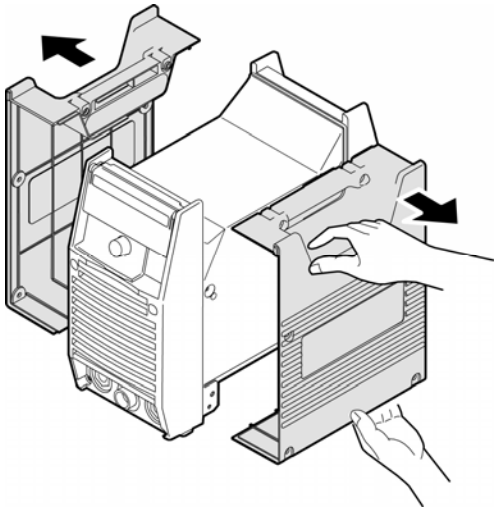


Figure 11-5 Remove Side Panel

f) Remove PCB Cover sheet by removing the four clips.

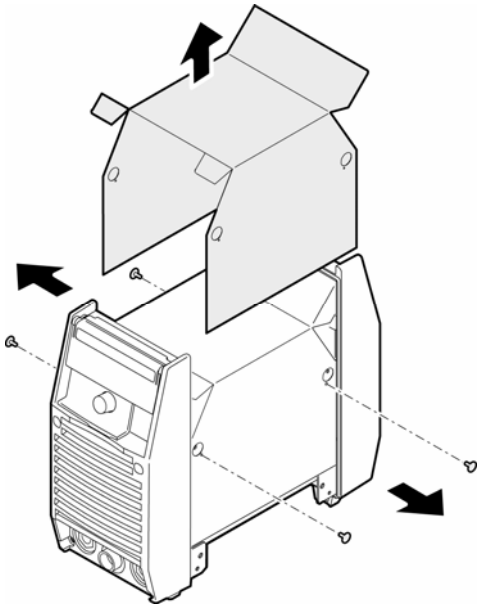


Figure 11-6 Remove PCB Cover

Note

When you re-assemble the parts, conduct the above process backwards.

11.02 Verification and Remedy to the Indicated Error Codes

Note

The capacitors inside the power supply will slowly discharged after you turn off the switch of the power supply or the switch at the breaker box (distribution panel). Wait at least 5 minutes for the discharge to complete and then remove the cases to continue your inspection and repair (or maintenance) inside the power supply. As for the removal and installation of the case, refer to section 11.01.1.

Note

*During the "**Verification/Remedy**" procedures below, follow the alphabetical sequence (a, b, c…) and proceed with your verification and confirmation.*

Note

After you Verify and replace all spare parts and components, Verify that there are no damaged harnesses or connectors, uninstalled or loose screws.

1. E01 "Over-Temperature at the primary side"

Cause:

Occurs when an over-temperature condition of the primary IGBT is detected.

Verification/Remedy:

a) Unit may be in thermal shutdown mode.

☐ Review the rated duty cycle of the unit per section 3.08. Exceeding the duty cycle can damage the unit and void the warranty. Refer also to section 1.06 for additional information.

b) Verify the ventilating condition.

☐ Maintain a clear and unobstructed distance of more than 12-in. in the front and more that 20-in. in the rear of the unit for ventilation purposes.

☐ Verify and maintain clean, dust free, front and rear airflow paths. Cleaning and removing dust from the front and rear panels once every six months in a normal working environment is recommended. Extremely dusty environments will require more frequent cleanings.

c) Verify the operation of the cooling fan, FAN1, and replace it if necessary.

☐ Verify the condition of FAN1. Verify that there are no broken or cracked fan blades and that FAN1 is not producing abnormal sounds.

☐ If broken or cracked FAN1 blades, or abnormal sounds are emanating from FAN1, replace FAN1.

☐ Verify the operation of the cooling fan and replace it if the condition of FAN1 is inactive. Follow the instruction in section 12.03.11.

☐ Refer to section 11.05.3 for addition FAN1 tests.

☐ Refer to section 12.03.11 for the replacement of FAN1.

d) Replace PCB4 (WK-5449) and PCB5 (WK-5448).

☐ Refer to section 12.03.4, 12.03.5 for the replacement of PCB4 and PCB5.

2. E02 "Over-Temperature at the secondary side"

Cause:

Occurs when an over-temperature condition of the secondary IGBT and diode are detected.

Verification/Remedy:

a) Unit may be in thermal shutdown mode.

☐ Review the rated duty cycle of the unit per section 3.08. Exceeding the duty cycle can damage the unit and void the warranty.

b) Verify the ventilating condition.

☐ Maintain a clear and unobstructed distance of more than 12-in. in the front and more that 20-in. in the rear of the unit for ventilation purposes.

☐ Verify and maintain clean, dust free, front and rear airflow paths. Cleaning and removing dust from the front and rear panels once every six months in a normal working environment is recommended. Extremely dusty environments will require more frequent cleanings.

c) Verify the operation of the cooling fan, FAN1, and replace it if necessary.

☐ Verify the condition of FAN1. Verify that there are no broken or cracked fan blades and that FAN1 is not producing any abnormal sounds.

☐ If broken or cracked FAN1 blades, or abnormal sounds are emanating from FAN1, replace FAN1.

☐ Verify the operation of the cooling fan and replace it if the condition of FAN1 is inactive. Follow the instruction in section 12.03.11.

☐ Refer to section 11.05.3 for additional FAN1 tests.

☐ Refer to section 12.03.11 for the replacement of FAN1.

d) Replace PCB4 (WK-5449) and PCB5 (WK-5448).

☐ Refer to section 12.03.4, 12.03.5 for the replacement of PCB4 and PCB5.

3. E03 "Primary Over-Current Failure"

Cause:

Occurs when excessive current is detected flowing into the primary side of the main transformer.

Verification/Remedy:

a) Verify the operation of the machine within the rated specification.

☐ Refer to the specification data sheet in Section 3.09.

b) Verify the secondary diode (D2 and D3).

☐ Refer to section 11.05.6 for the test of D2 and D3.

☐ Refer to section 12.03.8 for the replacement of D2 and D3.

c) Verify the H.F. unit (HF. UNIT1). only

☐ Refer to section 12.03.12 for the replacement of HF.UNIT 1.

d) Replace the Hall CT, CT1.

Note

Pay special attention to installed direction of CT1. The Hall CT will not function properly if installed in the incorrect direction.

☐ Refer to section 12.03.10 for the replacement of CT1.

4. E94 "Thermistor malfunction"

Cause:

Thermistors for detecting temperature of internal components have malfunctioned.

Verification/Remedy:

a) Verify a secure connection of the harness wired between CN5-6 on PCB1 (WK-5466) and Thermistors (TH1, TH2).

☐ Re-install the harness with a secure connection.

☐ Contact the manufacturer if you find any broken connectors or damaged wiring harness.

b) Replace thermistors (TH1, TH2).

☐ Refer to sections 12.16 and 12.17.

c) Replace PCB5 (WK-5448).

☐ Refer to section 12.03.5.

5. E99 "Initial Power Receiving"

Cause:

Occurs when the initial AC power received signal has not reached the CPU. This error occurs normally during the power "OFF" sequence of the unit.

Verification/Remedy:

a) Verify the connection between "+" terminal of Primary diode (D1) and PCB1 (WK-5466).

☐ Verify that there is no omission of a loosening connected wire between the PCB1 and D1.

☐ Contact the manufacturer if you find any broken connectors or damaged wire.

b) Verify that there is no omission of a loosening screws and connected harness with PCB1 (WK-5466).

☐ Re-install the harness with a secure connection.

☐ Contact the manufacturer if you find any broken connectors or damaged wiring harness.

☐ Replace PCB1. Refer to section 12.03.1.

c) Replace PCB4 (WK-5449) and PCB5 (WK-5448).

☐ Refer to section 12.03.4, 12.03.5 for the replacement of PCB4 and PCB5.

11.03 Verification and Remedy to Failures without Indication Codes

Refer to Note on Section 11.02.

1. "Cooling Fan (FAN1) Failure" (Fan is not rotating.)

Cause:

Occurs when the cooling fan (FAN1) is defective, damaged or the driving voltage is incorrect.

Verification/Remedy:

a) Verify the cooling fan (FAN1).

- ☐ Inspect the condition of the fan blades and all peripheral parts. Clean the fan blades and all peripheral parts if covered with dust. Cleaning and removing dust from the fan blades once every 6 months in a normal environment is recommended. Extremely dusty environments will require more frequent cleanings.
- ☐ Verify that there are no wiring harnesses entangled inside the fan, Verify that the harnesses do not have any breaks in the wire or damaged connectors.
- ☐ Replace wiring harnesses if you find any broken connectors or damaged wiring harnesses.
- ☐ Replace the fan if there are any broken, cracked or missing fan blades. Refer to section 12.03.11.

b) Verify the wiring harness between the cooling fan (FAN1) and CN2 on PCB1 (WK-5466).

- ☐ Verify a secure connection of the harness to CN2 on PCB1.

c) Verify the drive circuitry of the cooling fan (FAN1) on PCB1.

- ☐ Verify the drive circuitry of the cooling fan (FAN1) on PCB3.
- ☐ Refer to section 11.05.3.
- ☐ Replace PCB1 if necessary. Refer to section 12.03.1.

2. "Gas Valve Failure" (No Gas flow through unit)

Cause:

Occurs when the gas valve (SOL1) is defective, damaged or the driving voltage is incorrect.

Verification/Remedy:

a) Verify that TIG welding is selected on the welding mode.

- ☐ Do not change welding modes while welding. Only change welding modes when the unit is idle (torch switch OFF).
- ☐ Verify the setting of Pre-flow and Post-flow on the front panel. If the Pre-flow or Post-flow time is set to 0 seconds, change them to higher setting.

b) Verify the layout of the gas hose.

- ☐ Verify that the hose is securely connected into the fitting at the inlet and the outlet. Verify the layout of the gas hose so that it is not bent or kinked. Verify there are no breaks, burns or holes in the hose.
- ☐ Verify the layout of the TIG torch gas hose and that the hose adapters are properly connected.

c) Verify the wiring harness and connection of gas valve (SOL1) and CN2 on PCB1 (WK-5466).

- ☐ Verify a secure connection of the harness to CN2 on PCB1.

d) Verify the drive circuitry of the gas valve (SOL1).

- ☐ Verify the drive circuitry of the gas valve (SOL1).
- ☐ Refer to section 11.05.4.
- ☐ Replace PCB1, when abnormal. Refer to section 12.03.1.

e) Replace PCB4 (WK-5449) and PCB5 (WK-5448).

☐ Refer to section 12.03.4, 12.03.5 for the replacement of PCB4 and PCB5.

3. "No Weld Output"

When in High Frequency TIG (HF TIG) mode, if the High Frequency is not generated (present), refer to "High Frequency Output Failure" in section 11.03.5.

Cause:

Occurs when the remote connector (CON1) or associated circuitry is defective, damaged, or the TIG torch cable is defective.

Verification/Remedy:

Caution

Read and understand this entire section before proceeding. Extreme personal harm and test equipment damage will occur if the procedures are not performed accurately.

a) Verify the remote connector (CON1). (Applies to LIFT TIG and High Frequency TIG [HF TIG] mode.)

☐ Verify a secure connection between the remote connector (CON1) and the TIG torch cable.

☐ Verify a secure connection of the harness and the connections between the remote connector (CON1) and CN1 on PCB1 (WK-5466) are all correct and there are no open circuits.

☐ Contact the manufacture if you find any broken connectors or damaged wiring harnesses.

☐ Verify the proper pins-outs of the remote connector at the TIG Torch side. (Refer to section 4.01.2.)

☐ Verify that there is no open circuit on the remote connector at TIG Torch side.

☐ In equipment for remote control use, Verify the pin specification of a connector. (Refer to section 4.01.2.)

b) Verify the condition and connections of the welding cable, the stick rod holders and the ground clamp. (Applies to all welding modes.)

☐ Verify a secure connection of the welding cable, stick rod holders, ground clamp and dinse connectors and there are no open circuits.

c) Verify the no-load voltage (OCV). (Applies to STICK, High Frequency TIG (HF TIG) mode.)

☐ Refer to the section "Verification of No-load voltage (OCV)" in section 11.05.8.

☐ If performing the "No-Load Voltage Failure" procedure does not rectify the failure, perform the following tests in the sequence below. Replace any defective components found.

1, Secondary diode (D2-D3)

☐ Verification. Refer to section 11.05.6.

☐ Replacement. Refer to section 12.03.8.

2, Coupling coil (C.C.) and Reactor (FCH1)

☐ Replacement C.C. Refer to section 12.03.9.

☐ Replacement FCH1. Refer to section 12.03.9.

3, Transformer (T1)

☐ Replacement T1. Refer to section 12.03.3.

4, Primary IGBT (Q1A-Q4C)

☐ Verification. Refer to section 11.05.7.

☐ Replacement. Refer to section 12.03.6, 12.03.7.

5, Hall C.T. (CT1)

☐ Replacement CT1. Refer to section 12.03.10.

4. "Operating Panel Failure" (LED's do not light properly or welding setting cannot be established.)

Cause:

Occurs when there is a connection failure among PCB1 (WK-5466), PCB5 (WK-5448), PCB6 (WK-5449) and PCB1 or PCB5 or PCB6 are defective.

Verification/Remedy:

a) Verify the harness connection between CN101 on PCB1 (WK-5466) and CN1 on PCB4 (WK-5449).

- ☐ Verify a secure connection of the harness and the connections between CN101 on PCB1 and CN1 on PCB5.
- ☐ Contact the manufacturer if you find any broken connectors or damaged wiring harnesses.

b) Verify the connection between PCB5 (WK-5448) and PCB4 (WK-5449).

- ☐ Verify that there are no loose screws or harness connections between the PCB4 and PCB5.
- ☐ Replace PCB4 and PCB5 if necessary. Refer to section 12.03.5, 12.03.6.

5. "High Frequency Output Failure" (Unit does not generate High Frequency.)

Cause:

Occurs when the High Frequency unit (HF UNIT1) is defective or blown.

Verification/Remedy:

Caution

Read and understand this entire section before proceeding. Extreme personal harm and test equipment damage will occur if the procedures are not performed accurately. The unit will generate a High Voltage component that can cause extreme personal harm and test equipment damage.Capacitors installed inside the Welding Power Source are electrically charged for a while after the Mains ON/OFF switch or distribution panel switch has been turned off. Before inspecting the inside of the Welding Power Source, leave it for about 5 min. after switching off power for discharging the capacitors, and then remove the top and side panels.

a) Verify the connection between High Frequency Unit (HF UNIT1) and Coupling Coil (C.C.).

- ☐ Verify the connection between the HF UNIT1 and C.C.. Verify that the quick-disconnect terminals are inserted onto the terminals of HF UNIT1 (TB5- TB6) correctly and completely.
- ☐ Verify there are no short circuits, burnt or broken wires at C.C..
- ☐ Replace C.C.. Refer to section 12.03.9.

b) Verify the connection between High Frequency Unit (HF UNIT1) and the current limiting resistor (R6 on WK5609 PCB3).

- ☐ Verify that the quick-disconnect terminals are inserted onto the terminals of HF UNIT1 (TB3-TB4) correctly and completely.

☐ Verify there are no short circuits, burnt or broken wires between the HF UNIT1 and R6 on WK5609 PCB3. Its resistance can be measured across pins 1 and 3 of CN3 (PCB3) WK5609.

c) Verify the connection between the terminals between AC1-AC2 (TB1-TB2).

☐ Verify the connection between AC1-AC2. Verify that the quick-disconnect terminals are inserted onto the terminals of HF UNIT1 correctly and completely.

☐ Verify there are no short circuits, burnt or broken wires between AC1 and AC2.

d) Verify and replace the Gap (GAP) of the High Frequency Unit (HF UNIT1).

☐ Verify that the GAP is connected to HF UNIT1 correctly and completely.

☐ Verify there is no dust or foreign debris between the space of the GAP.

☐ If there are any abnormalities observed with the GAP, replace the GAP.

☐ The gap is set to 1.0mm.

In the case of a gap 1.0mm or more, high frequency voltage and period increases.
In the case of a gap 1.0mm or less, high frequency voltage and period decreases.

e) Replace the High Frequency (HF UNIT1).

☐ Refer to section 12.03.12.

f) Replace PCB3 (WK-5609).

☐ Refer to section 12.03.3.

11.04 Fault Isolation Tests

1. Preparation

The following initial conditions must be met prior to starting any of the procedures in this section.

a) Connect the appropriate input voltage. (Check the name plate on the rear of the power supply for the proper input voltage.)

Note

Operate at all input voltages as noted on the nameplate on the rear panel when testing the power supply.

b) Remove the Side Panel. Refer to the section 11.01.1.

c) Close primary power source wall disconnect switch or circuit breaker.

d) Place power supply MAIN CIRCUIT SWITCH (S1) on rear of the unit in the ON position.

WARNING

Dangerous voltage and power levels are present inside this unit. Be sure the operator is equipped with proper gloves, clothing and eye and ear protection. Make sure no part of the operator's body comes into contact with the work piece or any internal components while the unit is activated.

11.05 Verification of the Power Input Circuitry

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation"

1. Verification of the AC input voltage using an AC voltmeter.

a) Verify input voltage (Phase-to Phase) using an AC voltmeter. (The capability of the voltmeter should be more than 600VAC). Measure the point between lines U1 and V1 on the input switch, S1. The location of points U1 and V1 on switch S1 are indicated in Figure 11-7.

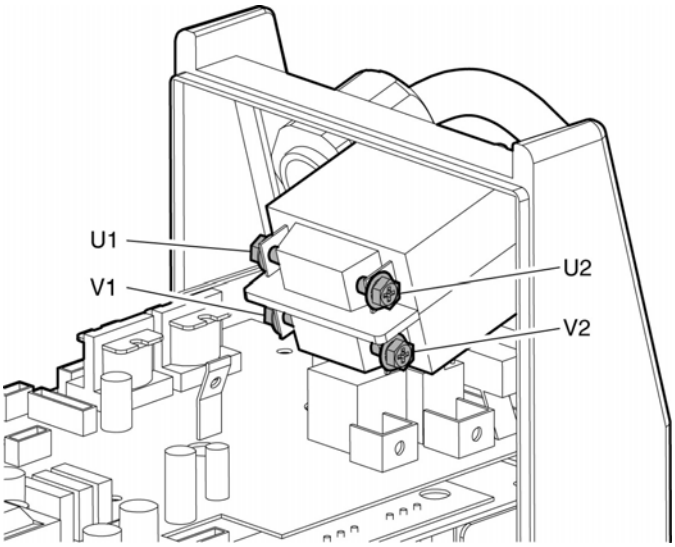


Figure 11-7: Check points U1, U2, V1 and V2

b) If the input voltage is out of the operating range of the unit, which is ± 10% (187 ~ 253VAC) of the rated voltage (208-230V), verify the available power capacity at the installed site. If the input voltage is within the operating range, recheck the input voltage while welding, as welding may cause the input voltage to decrease to a value below the operating range of the unit.

c) Verify input voltage after the input switch (S1) using an AC voltmeter. (The capability of the voltmeter should be more than 600VAC.)

☐ Using an AC voltmeter, measure between the points U2 and V2 on the input switch, S1.

The location of points U2 and V2 on switch S1 are indicated in Figure 11-7.

d) If this voltage is out of the operating range, which is ± 10% (187 ~ 253VAC) of the rated voltage (208-230), replace S1 following the process in section 12.3.14.

e) Verify the rectified output voltage of the primary diode, D1 using a DC voltmeter. (The capability of the voltmeter should be more than 400VDC.) Using a DC voltmeter, measure between the points "+" [+] and "-" [-] on D1. Points "+" and "-" are on PCB1 (WK-5466). See Figure 11-8. The measured voltage should be approximately 1.4 times larger than input voltage

measured in #1 above. Replace diode D1 if the calculated measurement is not within the corresponding range (260 ~ 360VDC) following the process in section 12.03.1.

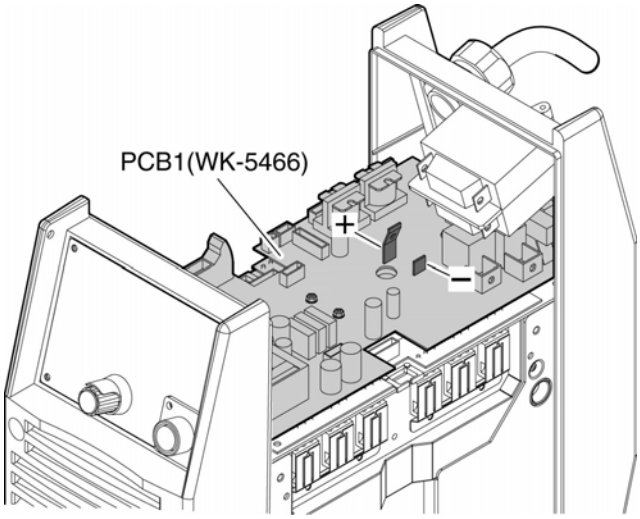


Figure 11-8: The check points "+" and "-"

f) Verify bus voltage (the voltage of the electrolytic capacitor after rectification) using a DC voltmeter. (The capability of the voltmeter should be more than 500VDC.) Using a DC voltmeter, measure between the points TB1(P)[+] and TB3(N)[-] on PCB1 (WK-5466). See Figure 11-9. Points TB1(P) and TB2(N) can be found on the parts side of PCB2. The measured voltage should be approximately 1.4 times larger than input voltage measured in #1 above. Replace diode D1 if the calculated measurement is not within the corresponding range (260 ~ 360VDC) following the process in section 12.03.1.

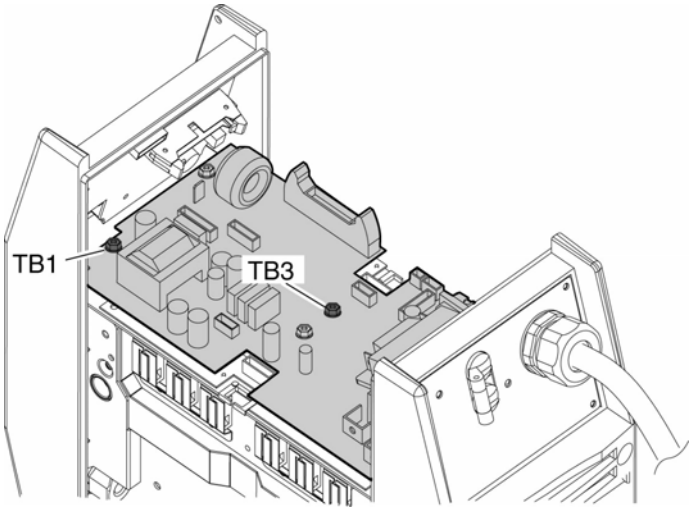


Figure 11-9: The check points TB1(P) and TB3(N)

g) After the replacement of D1, if the above voltage is still abnormal, replace PCB1 (WK-5466).

2. Verification of the Power Supply Voltage

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation" .

a) Verify Power Supply voltage using an DC voltmeter. (The capability of the voltmeter should be more than 50VDC.) Operate at all input voltages as noted on the nameplate on the rear panel when testing the power supply.

b) On the PCB5 (WK-5448) and PCB4 (WK-5449), measure the voltages according to the following table. The check points and the reference are obtainable on the solder side of PCB4 (WK-5449). The locations of points are indicated in Figure 11-10.

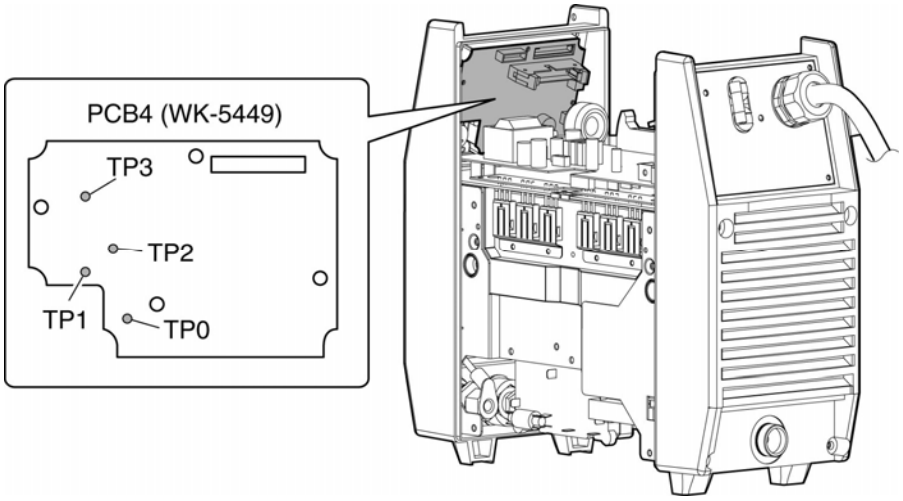


Figure 11-10: Checkpoints TP0-TP3 on PCB6

Check Point PCB6	Reference PCB6	ACCEPTABLE VALUE
TP1	TP0	+5VDC
TP2	TP0	+12VDC
TP3	TP0	-12VDC

Table 11-1: Checkpoints TP0-TP3 on PCB6

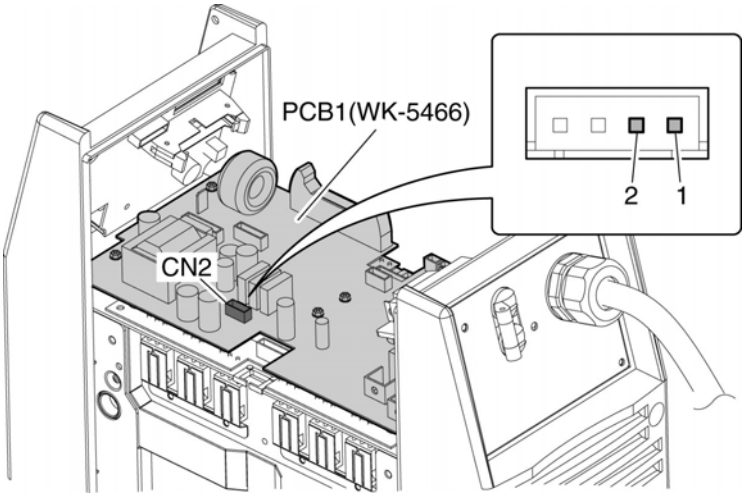


Figure 11-11: Checkpoints CN2 on PCB1

Check Point PCB1	Reference PCB1	ACCEPTABLE VALUE
Pin 1 on CN2	Pin 2 on CN2	+24VDC

Table 11-2: Checkpoints CN2 on PCB1

c) If any of these voltages are not present or are below a 10% tolerance, replace the PCB1 (WK-5466). Refer to section 12.03.1.

3. Verification of the Cooling Fan, FAN1, Drive Circuitry

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation" .

a) Verify the condition of the cooling fan, FAN1, using a DC voltmeter. (The capability of the voltmeter should be more than 50VDC.) Using a DC voltmeter, measure between PIN 1 (Positive [+]) and PIN 2 (Negative [-]) of CN11 on PCB1 (WK-5466). The location of connector CN2 of PCB3 is indicated in Figure 11-12. When you measure the above voltage, do not remove the connector. Conduct the measurement while the connector plug and receptacle are still connected.

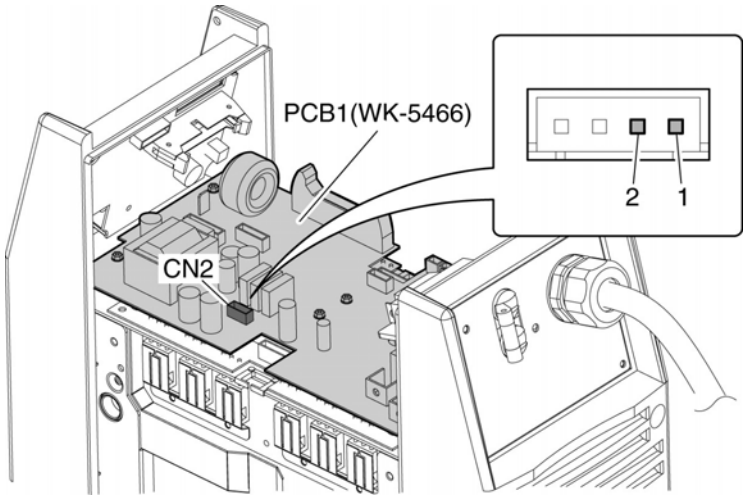


Figure 11-12: Verification of the FAN1

b) Using the measurement taken above, follow the chart below for possible failure modes.

	FAN1 Status	Voltage measurement. (PIN1–PIN2 of CN2 on PCB1)	Remedy
Case 1	Rotating	DC 18 ~ 25V	FAN1 drive circuit is normal.
Case 2	Rotating	Below DC 18V	Replace PCB1. Refer to section 12.03.1.
Case 3	Inactive	Below DC 18V	Replace PCB1. Refer to section 12.03.1. Perform “Verification of the Power Supply Voltage”. Refer to section 11.05.2.
Case 4	Inactive	DC 18 ~ 25V	Replace the FAN1. Refer to section 12.03.11.

Table 11-3: Verification of the FAN1

☐ At the time of a low output and standby, fan rotation becomes slow. Therefore, exact voltage measuring becomes impossible.

☐ When verifying the voltage, Verify that the AC input voltage remain within the operating range of the unit. (The AC input does not drop below 180VAC).

4. Verification of the Gas Valve, SOL1, Drive Circuitry

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation".

a) Verify the voltage between the PIN3 (Positive [+]) and PIN4 (Negative [-]) of connector CN2 on PCB1 (WK-5466) while you press the torch switch while in TIG Mode. (The capacity of the voltmeter should be more than 50VDC.) The location of connector CN2 of PCB1 (WK-5466) is indicated in Figure 11-13. When you measure the above voltage, do not remove the connector. Conduct the measurement while the connector plug and receptacle are still connected.

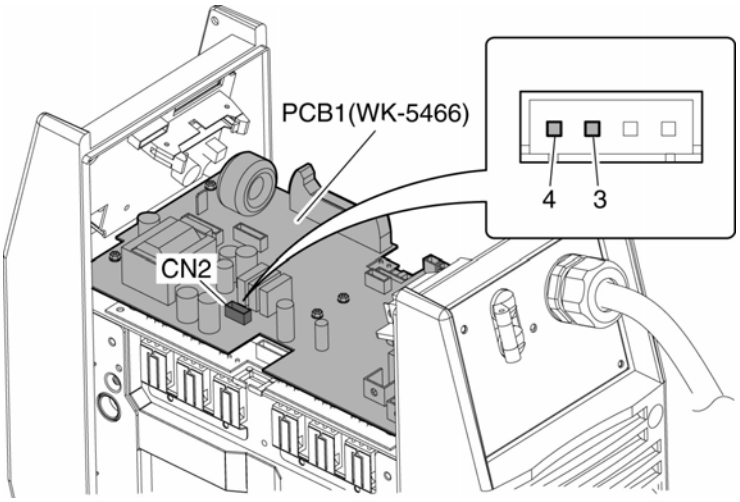


Figure 11-13: Verification of the SOL1

b) Using the measurement taken above, follow the chart below for possible failure modes.

	Voltage measurement. (PIN1–PIN2 of CN2 on PCB1)	Remedy
Case 1	Below DC 18V	Replace PCB1. Refer to the page 12-5.
Case 2	DC 18 ~ 25V	Replace SOL1. Refer to the page 12-20.

Table 11-4: Verification of the SOL1

c) When verifying the voltage, Verify that the AC input voltage remain within the operating range of the unit. (The AC input does not drop below 180VAC).

5. Verification of the primary Diode (D1)

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.4.1 "Preparation".

a) Verify the characteristic of the primary diode, D1, using a diode tester.

b) Refer to Table 11-5 and Figure 11-14 for the checkpoints on D1.

COMPONENT TESTED	TERMINALS		ACCEPTABLE VALUE
	Positive lead	Negative lead	
Diode of D1	1, 2, 3 5	5 1, 2, 3	0.3 to 0.5V Open
Diode of D1	1, 2, 3 4	4 1, 2, 3	Open 0.3 to 0.5V

Table 11-5: Tester checkpoints for D1

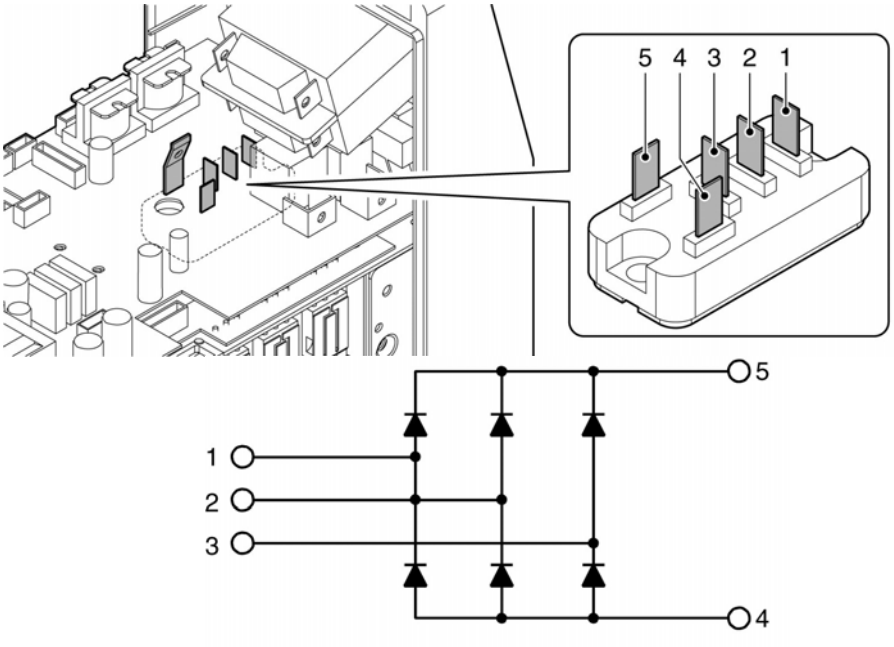


Figure 11-14: Tester checkpoints in the D1 interconnection diagrams

6. Verification of the secondary Diode (D2, D3)

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation".

a) Verify the characteristic of the secondary diode, D2 and D3, using a diode tester.

b) Refer to Table 11-6 and Figure 11-15 for the checkpoints on D2 and D3.

COMPONENT TESTED	TERMINALS		ACCEPTABLE VALUE
	Positive lead	Negative lead	
Diode 1 of D2 and D3	Anode Cathode	Cathode Anode	0.2 to 0.3V Open
Diode 2 of D2 and D3	Anode Cathode	Cathode Anode	0.2 to 0.3V Open

Table 11-6: Tester checkpoints for D2 and D3

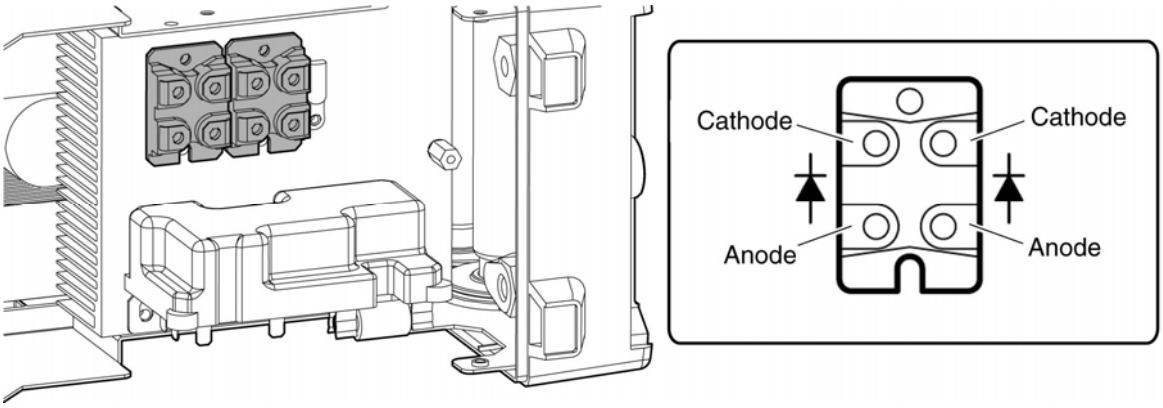


Figure 11-15: Tester checkpoints for D2 and D3

7. Verification of the primary IGBT (Q1A-Q4C)

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation".

a) Check whether there are any abnormalities on the appearance of PCB6 and PCB7.

b) Verify the characteristic of the primary IGBT (Q1A-Q4C), using a diode tester.

c) Refer to Table 11-7 and Figure 11-16 for the checkpoints on PCB6 and PCB7.

COMPONENT TESTED	TERMINALS		ACCEPTABLE VALUE
	Positive lead	Negative lead	
Collector-Emitter of Q1A ~ Q2C with PCB6	C CE	CE C	Open 0.2 to 0.5V
Collector-Emitter of Q3A ~ Q4C with PCB7	CE E	E CE	Open 0.2 to 0.5V

Table 11-7: Tester checkpoints for Q1A-Q4C

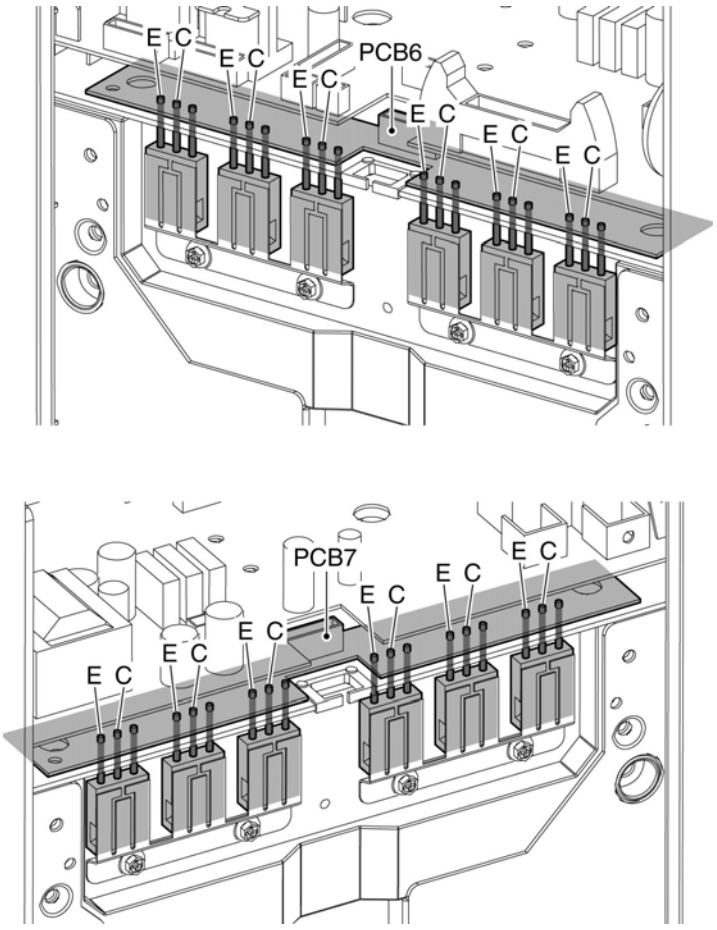


Figure 11-16: Tester checkpoints for Q1A-Q4C

8. Verification of No-load Voltage (OCV)

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation" .

a. Verify the no-load voltage in STICK mode.

1) In STICK welding mode, mark and then turn potentiometer VR1 on PCB4 (WK-5449) fully counter-clockwise to turn off the electric shock protector function (Voltage-Reduction-Device, VRD). Refer to section 9.02.

WARNING

Electric shock hazard. The unit will generate OCV immediately when Process mode is put into the state of "ON" pushing Process button enabling STICK mode.

2) Verify the no-load voltage using a DC voltmeter. (The capability of the voltmeter should be more than 100VDC.)

3) The normal no-load voltage is approximately 65V.

b. Verify the no-load voltage (OCV) in High Frequency TIG mode.

WARNING

This welding mode produces high frequency and high voltage. Extra care shall be taken to prevent electric shock.

1) When in HF TIG mode, the unit will generate high voltage. To prevent personal harm and test equipment damage, mark and then remove the indicated wire from the HF UNIT1 shown in Figure 11-17. To prevent electric shock, always wrap the removed wire with electrical tape or other suitable insulation.

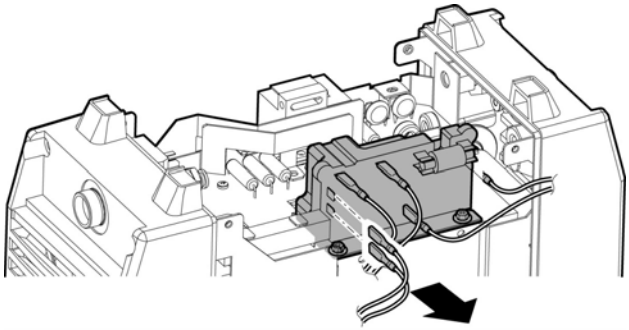


Figure 11-17 Removal and installation from the HF UNIT1
(To disable the operation of the HF unit.)

2) Press the Welding mode selection button to select HF TIG welding mode.

3) While depressing the Torch switch, verify the OCV using a DC voltmeter. (The capability of the voltmeter should be more than 100VDC.) The check point with a tester is the voltage between output terminal + and -. In TIG mode, the OCV ceases 3 seconds after you depress the torch switch.

4) The normal no-load voltage is approximately 65V.

5) Return the setting variable resister (VR1) to the original position. (Return to the position recorded by "a. 1)" clause.)

☐ Fully clockwise: VRD ON

☐ Fully counter-clockwise: VRD OFF

6) Return connection with HF UNIT1 to the original position.

9. Output Load Test

This test verifies that the output current, (amperage) controls are functioning properly. A clamp-type amperage meter or equivalent meter capable of reading approximately 160A full-scale will be needed for this test.

CAUTION

Before performing any portion of the procedure below, make certain the unit is placed in the initial set up condition as described in section 11.04.1 "Preparation".

a) Connect the POSITIVE (+) and NEGATIVE (-) OUTPUT TERMINALS to a piece of metal, separated by approximately three feet (one meter).

b) Connect the clamp-on amperage meter or equivalent to the output loop between the POSITIVE (+) and NEGATIVE (-) OUTPUT TERMINALS.

c) Place the power supply MAIN ON/OFF SWITCH (S1) on the rear of the unit to the ON position.

d) Select HF TIG mode and DC mode.

WARNING

This welding mode produces high frequency and high voltage. Extra care shall be taken to prevent electric shock.

e) Select WELD position, press control knob. Set minimum current (counterclockwise).

f) Depress the torch switch. The amperage meter will indicate approximately 5 Amps.

g) Slowly turn the Control Knob clockwise to the maximum of the power supply, then counter clockwise, back to 1 Amps as the control returns to its minimum position. The amperage meter should indicate a continuous range of Amperes between the 5 Amps minimum and the 160A maximum.

h) Set minimum current (counter clockwise).

i) Press the Welding mode selection button to select STICK welding mode. The amperage meter will indicate approximately 5 Amps.

WARNING

At this time, some voltage is applied to the stick electrode holder. Never touch the current conducting portion of it. Extra care shall be taken to prevent electric shock. Further, to prevent the risk of striking the arc inadvertently, care shall be taken to keep the work piece to be welded away from the said electrode holder.

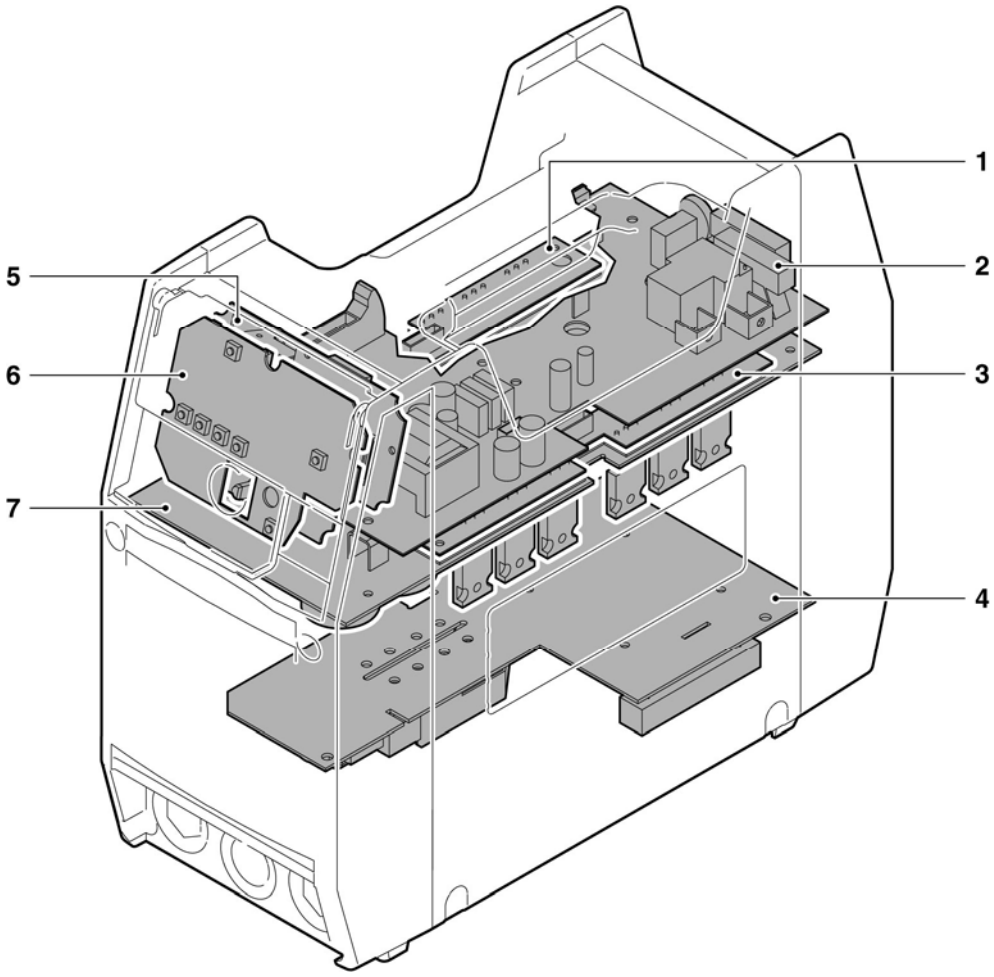
j) Slowly turn the Control Knob clockwise to the maximum of the power supply, then counter-clockwise, back to 1 Amps as the control returns to its minimum position. The amperage meter should indicate a continuous range of Amperes between the 5 Amps minimum and the 160A maximum.

k) Place the power supply MAIN ON/OFF SWITCH on the rear of the unit to the OFF position.

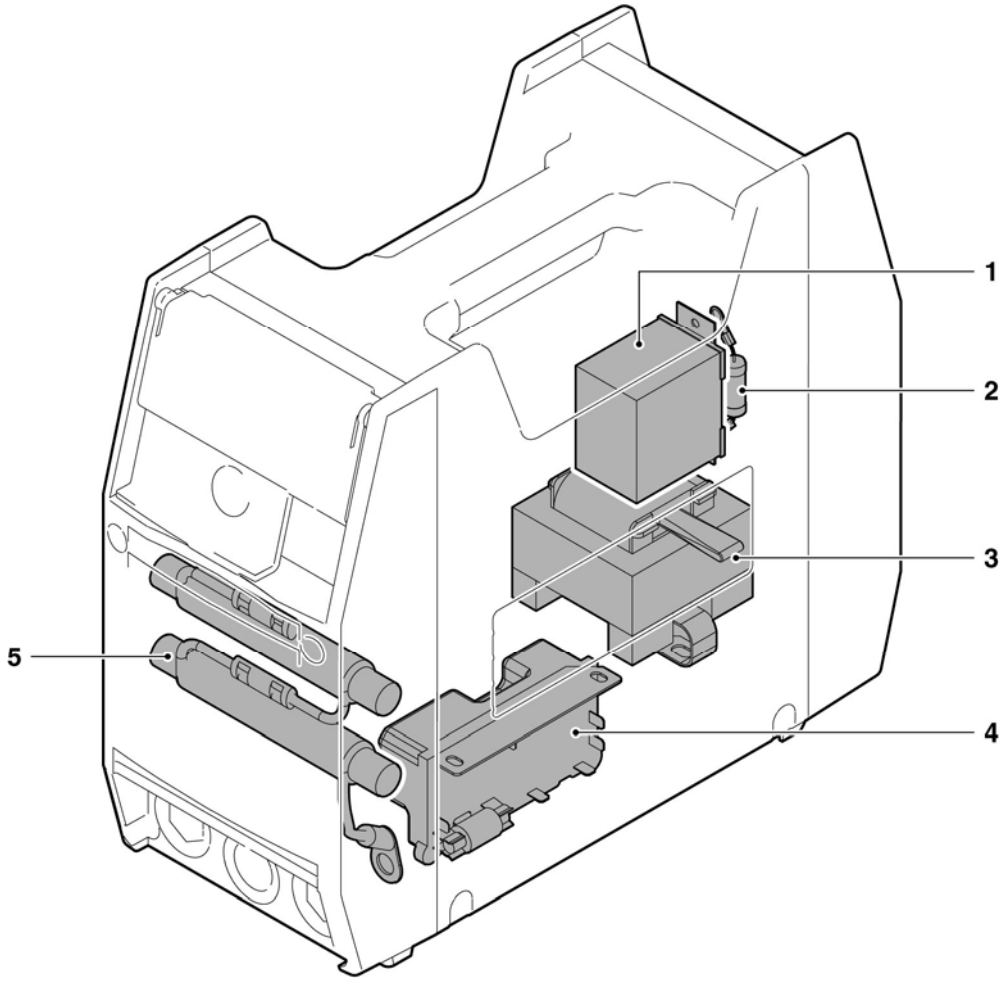
l) Remove the dead short between the OUTPUT TERMINALS.

SECTION 12:
MAINTENANCE

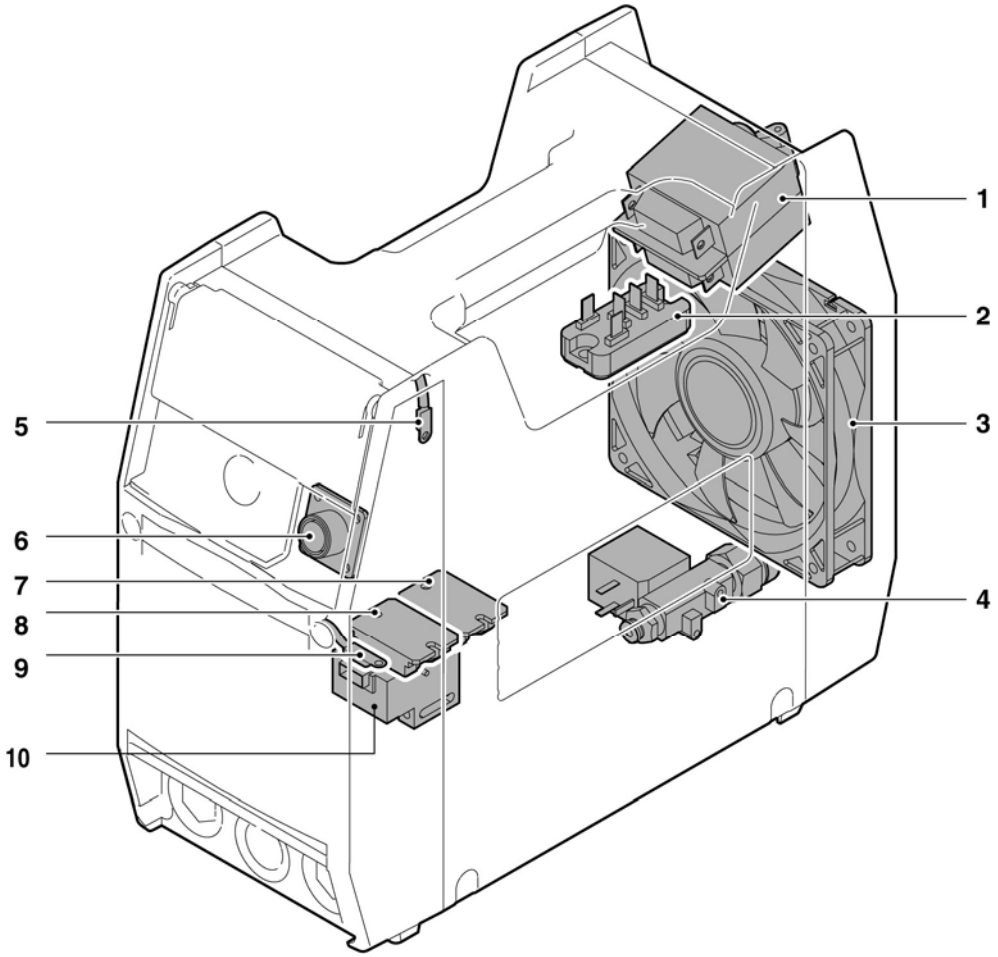
12.01 Maintenance List



NO.	DWG NO.	PARTS NAME	REFERENCE SECTION	PART NO.
1	PCB6(Q1A-Q2C)	Printed Circuit Board (WK-5460) Primary IGBT	12.03.6	W7001516
2	PCB1	Printed Circuit Board (WK-5466)	12.03.1	W7001403
3	PCB7(Q3A-Q4C)	Printed Circuit Board (WK-5460)	12.03.7	W7001516
4	PCB3	Printed Circuit Board (WK-5609)	12.03.3	W7001520
5	PCB4	Printed Circuit Board (WK-5449)	12.03.4	W7001412
6	PCB5	Printed Circuit Board (WK-5448)	12.03.5	W7001724
7	PCB2	Printed Circuit Board (WK-5467)	12.03.2	W7001405



NO.	DWG NO.	PARTS NAME	REFERENCE SECTION	PART NO.
1	C1	Capacitor	12.03.2	10-6510
2	R1	Resistor	12.03.2	W7001448
3	T1	Transformer	12.03.3	W7001501
4	HF UNIT	High Frequency Unit	12.03.12	W7001399
5	FCH1	Reactor	12.03.9	W7001502
6	C.C.	Coupling Coil	12.03.9	W7001384



NO.	DWG NO.	PARTS NAME	REFERENCE SECTION	PART NO.
1	S1	Main ON/OFF Switch	12.03.14	W7001453
2	D1	Primary Diode	12.03.1	W7001481
3	FAN1	Cooling Fan	12.03.11	10-5227
4	SOL1	Solenoid Valve	12.03.13	10-6645
5	TH1	Primary Thermistor	12.03.16	10-5228
6	CON1	Remote Connector	12.03.15	10-6627
7	D3	Secondary Diode	12.03.8	10-6229
8	D2	Secondary Diode	12.03.8	10-6629
9	TH2	Thermistor	12.03.17	10-5228
10	CT1	Hall Current Trans	12.03.10	10-5003

12.02 Service Tools

1. Tools and Parts
   The tools and parts to be used for maintenance are shown by icons.

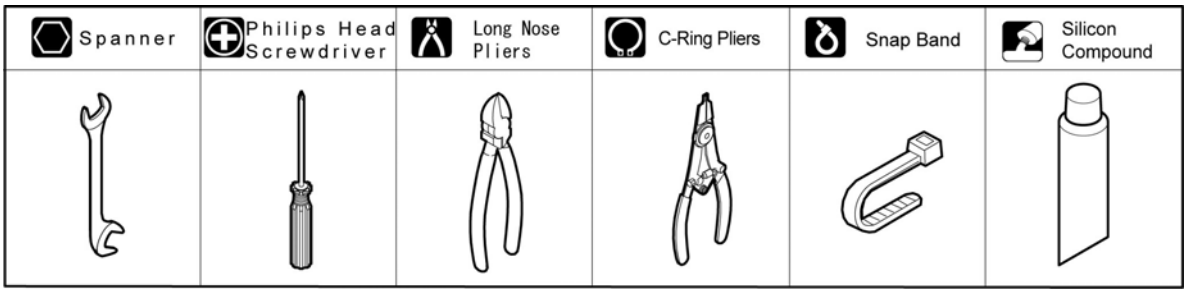


Figure 12-1 Icon of tool

2. Notes of disassembly and assembly

Note

When removing the locking type connectors and board supporters, disengage the locking mechanism first and then disconnect them.

Note

Locking type connectors and board supporters are indicated in this manual using the following symbols; black star marks for locking connectors and white star marks for locking board supports.

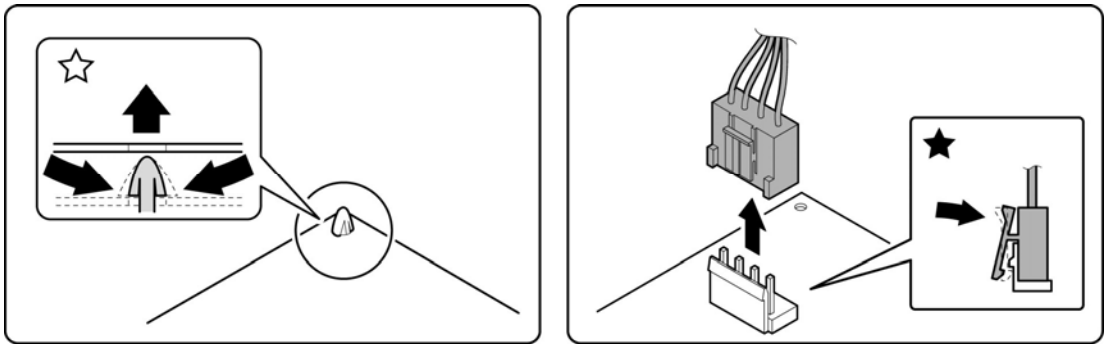


Figure 12-2 Locking type connectors and board supporters

Note

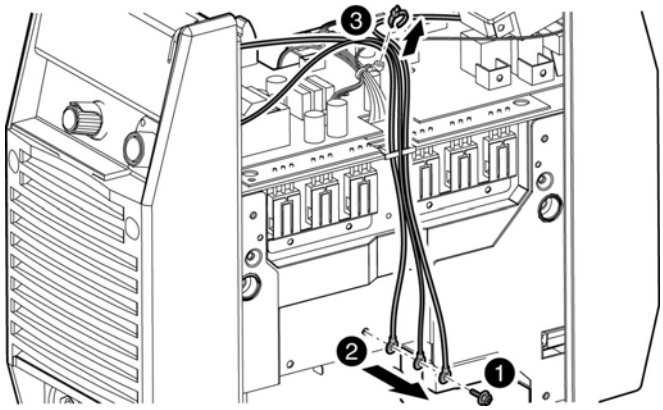
During your maintenance or repair, please cut any tie-wraps necessary. However, after your maintenance or repair, please re-assemble and tie-wrap all components and wiring in the same manner as before the maintenance or repair.

CAUTION

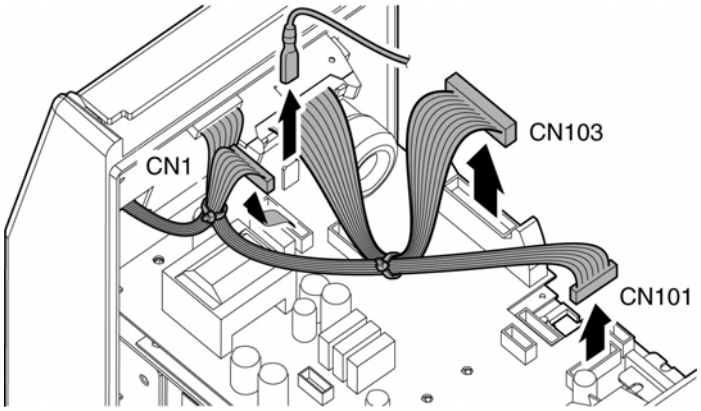
Please note that you remove each connector, grasp and pull out by the connector part only. Do not pull the harness (cable) part.

12.03 Replacement Procedure

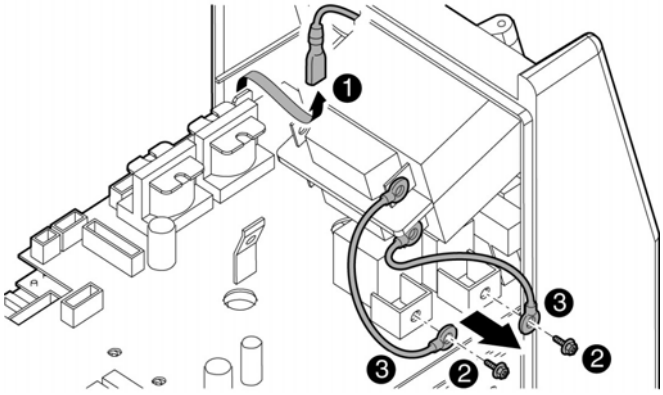
1. PCB1 (WK-5466) and Primary Diode D1
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the screw and three cables. Cut the snap band.



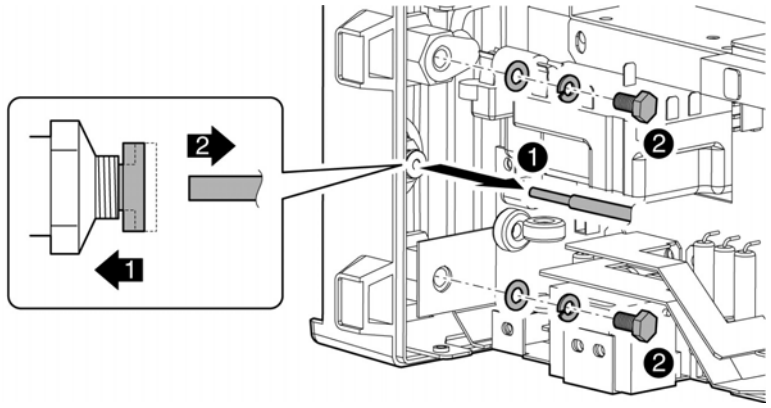
c) Remove the terminal and Disconnect the three connectors CN1 (PCB4), CN101,103 (PCB1).



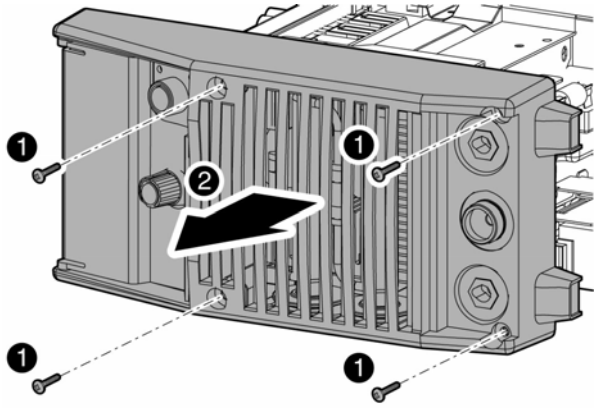
d) Remove the terminal and Remove the three cables.



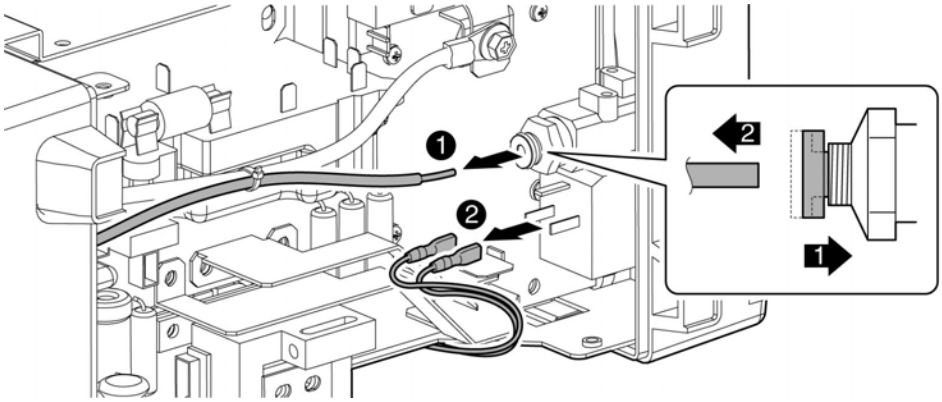
e) Remove the Gas Tube*. Remove the two bolts, two toothed washers, and the terminal.



f) Remove the four screws and the Front Panel.

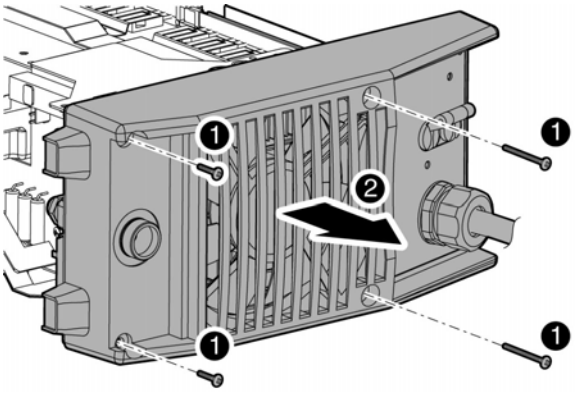


g) Remove the Gas Tube and the two cables.

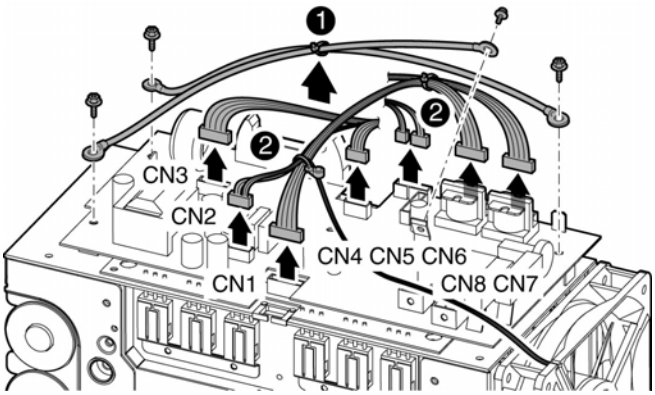


(Continued on next page.)

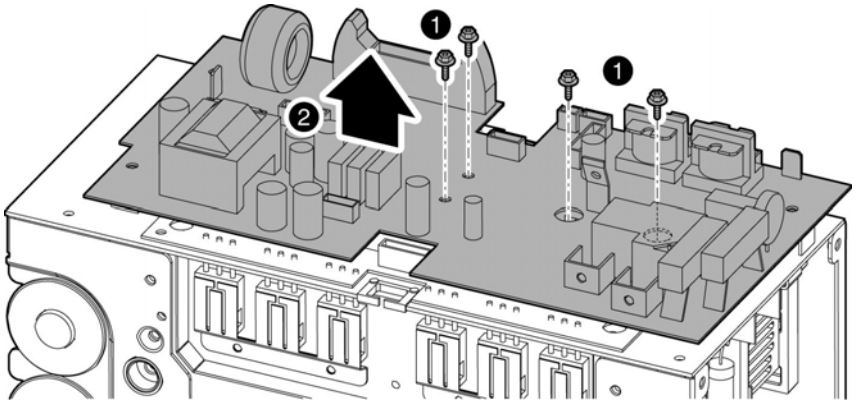
h) Remove the four screws and the Rear Panel.



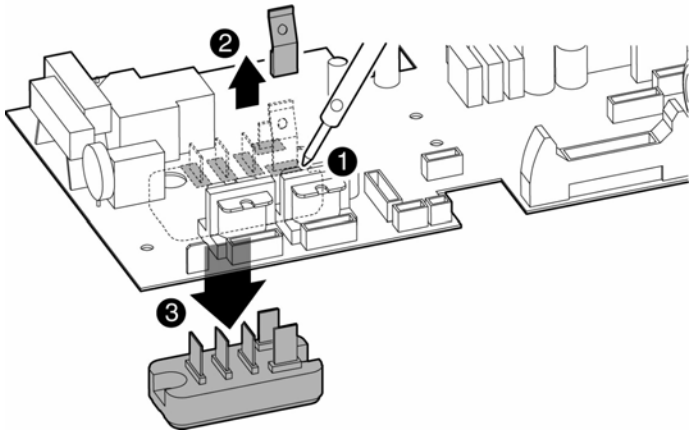
i) Remove the four screws and the two cables. Disconnect the eight connectors CN1-8 on the PCB1.



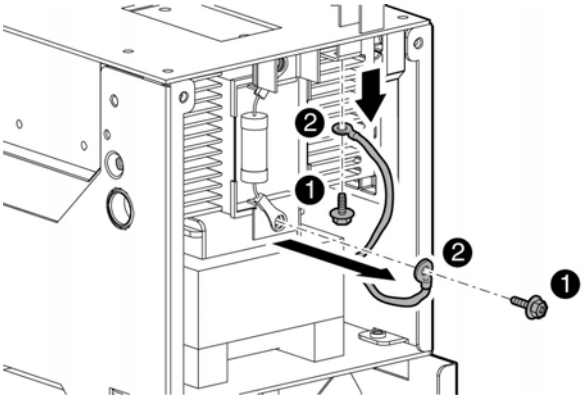
j) Remove the four screws and Remove the PCB1 unit.



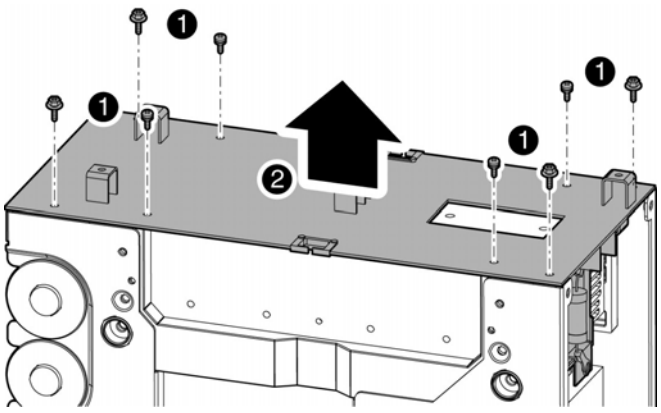
k) Remove the Primary Diode D1 with the soldering iron from the PCB1.
*Before installing a new diode, apply a uniform coat of silicone compound (Shinetsu Silicone G-747 or equivalent) on the base.



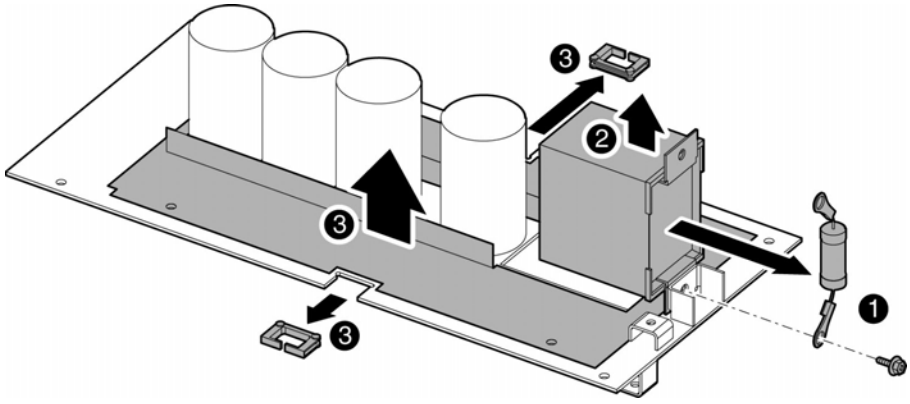
2. PCB2 (WK-5467), Capacitor C1 and Resistor R1
a) Remove the Side Panel. See section “11.01.1”.
b) Remove the PCB1 and D1. See section “12.03.1”.
c) Remove the PCB6 and PCB7. See section “12.03.6, 12.03.7”.
d) Remove the screw and the cable.



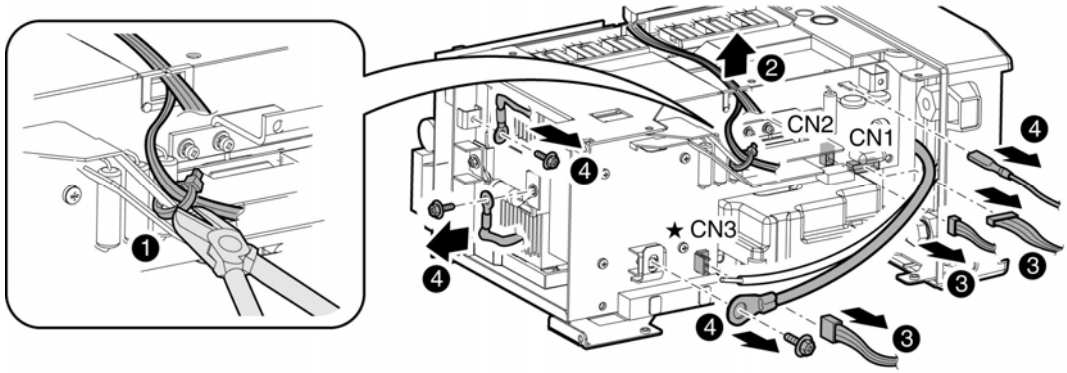
e) Remove the eight screws and the PCB2 unit.



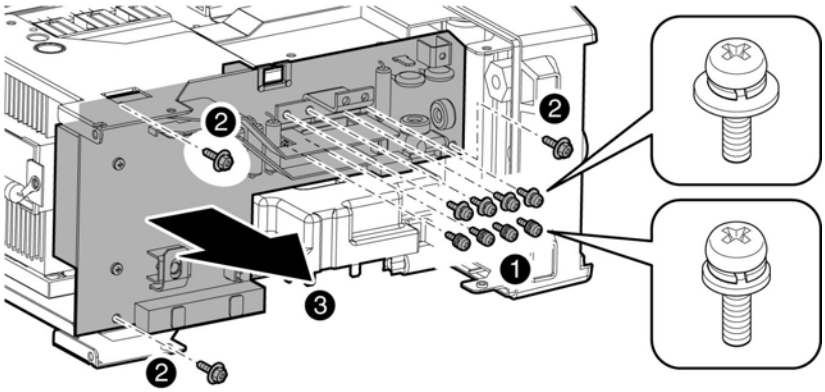
f) Remove the screw and Remove the Capacitor C1 and Resistor R1 from the PCB2. Remove the two edge holders and the PCB2 Insulation Sheet from PCB2.



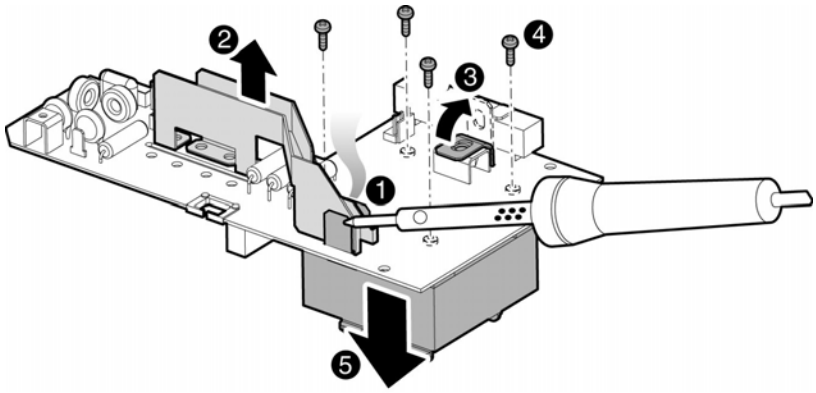
3. PCB3 (WK-5609) and T1 “Transformer”
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the CT1. See section “12.03.10”.
   c) Cut the snap band and Remove the cables. Disconnect the three connectors CN1-3 on the PCB3. Remove the three screws and the three cables. Remove the terminal.



   d) Remove the 11 screws and PCB3 unit.
   *Take note of the shape of the screw when you replace PCB3.



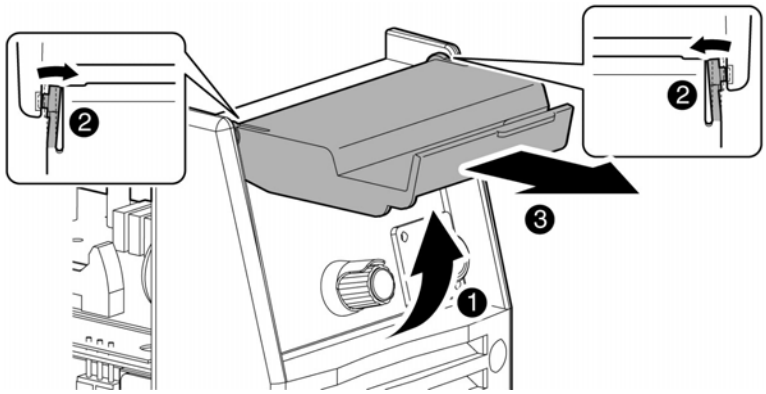
e) Remove the two tap of T1 with the soldering iron from the PCB3. Remove the T-D Bus Bar1 and the T-D Bus Bar2. Open the tap of T1 and Remove the four screws. Remove the T1 from the PCB3.



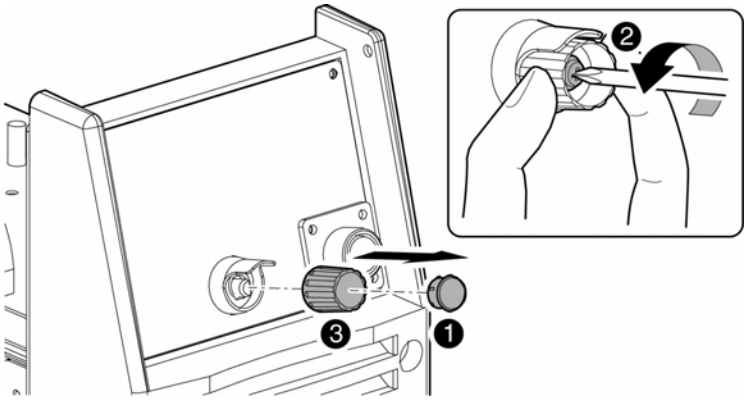
4. PCB4 (WK-5449)

a) Remove the Side Panel. See section “11.01.1”.

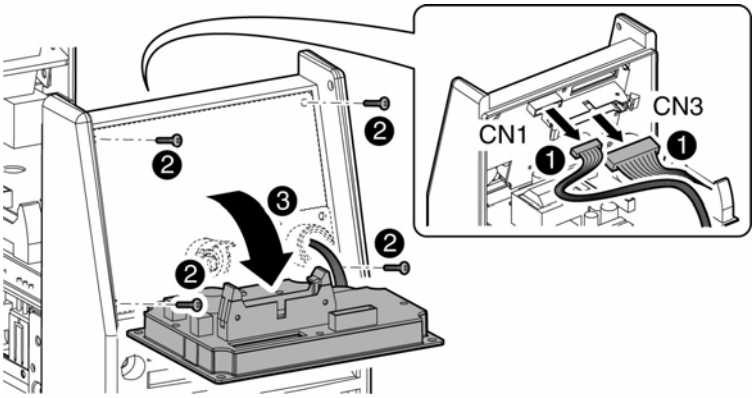
b) Remove the Protection Cover.



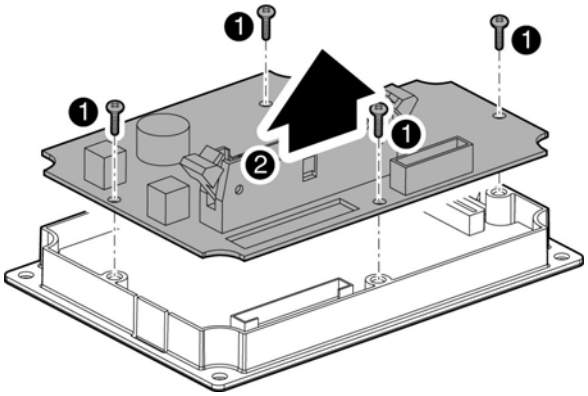
c) Remove the Knob Cap. Holding the Knob down, loosen the screw and remove the Knob.



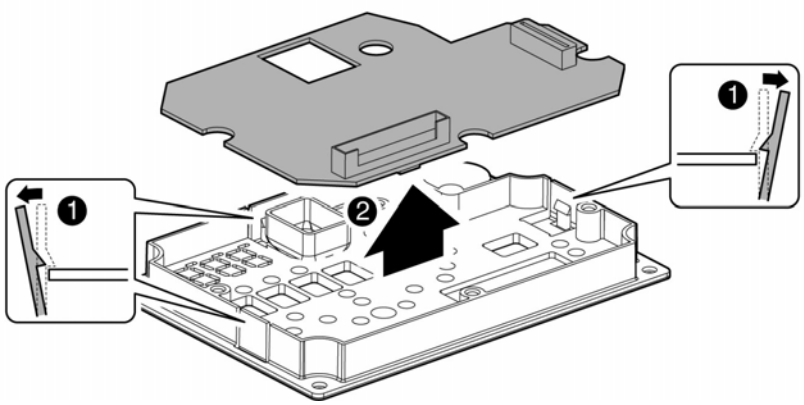
d) Disconnect the two connectors CN1,3 on the PCB4. Remove the four screws. Pull out the operation panel and bring it down.



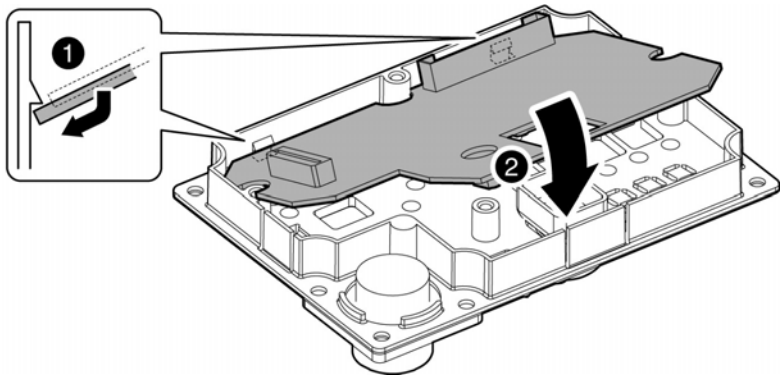
e) Remove the four screws. Remove the PCB4.



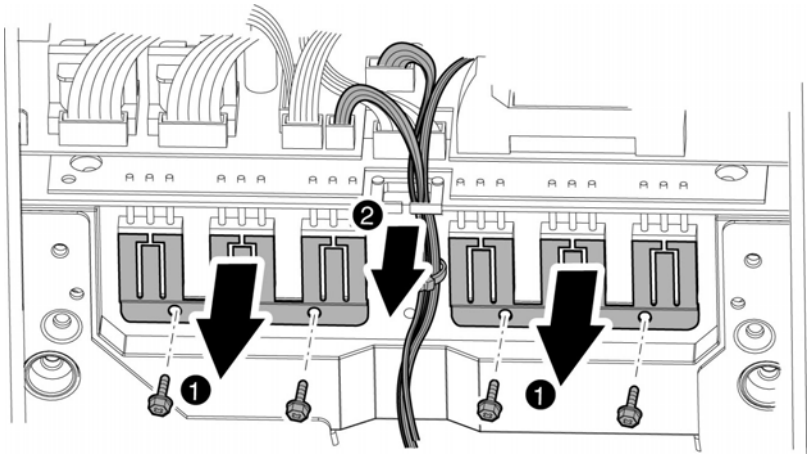
5. PCB5 (WK-5448)
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the PCB4. See section “12.03.4”.
   c) Remove the three latches of Front Control Cover and then remove the PCB5.



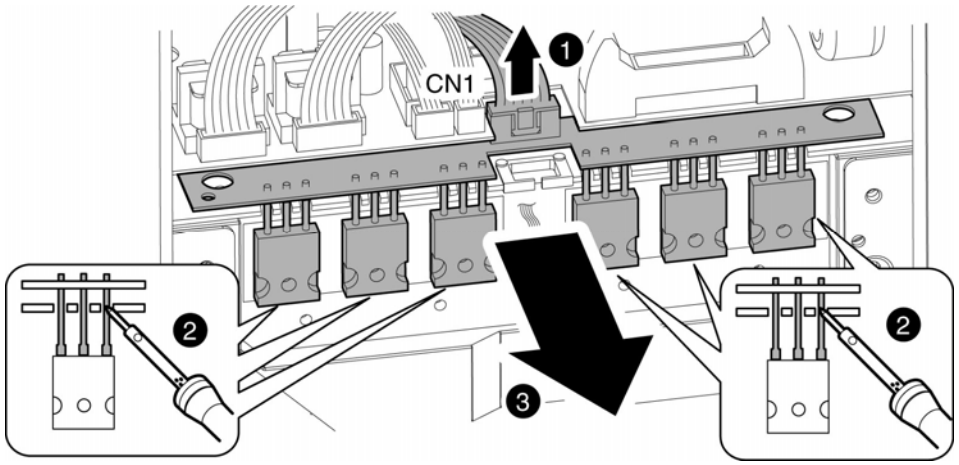
*When reinstalling the PCB5, engage two latches of Front Control Cover first.



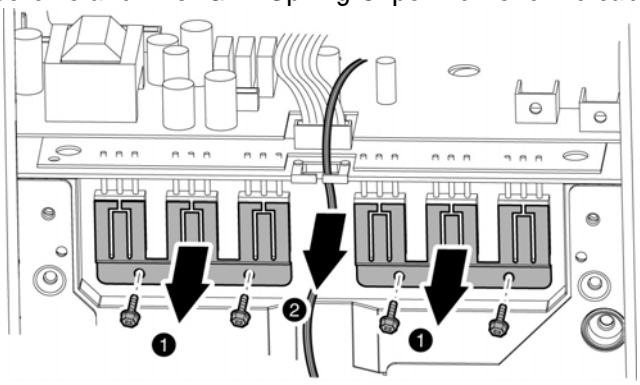
6. PCB6 (WK-5460) and Q1A-Q2C “Primary IGBT”
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the four screws and two IGBT Spring Clips. Remove the cables from edge holder.



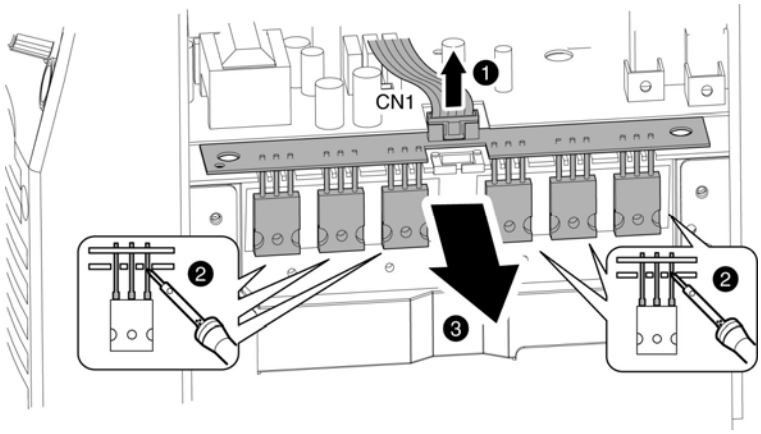
3) Disconnect the connector CN1 on the PCB6. Cut the lead of the Q1A-Q2C.
   *Remember to install new Silicone Rubber Sheets where silicone compound (Shinetsu Silicone G-747 or equivalent) was spread when reinstalling the PCB6. Spread the silicone compound on IGBT.



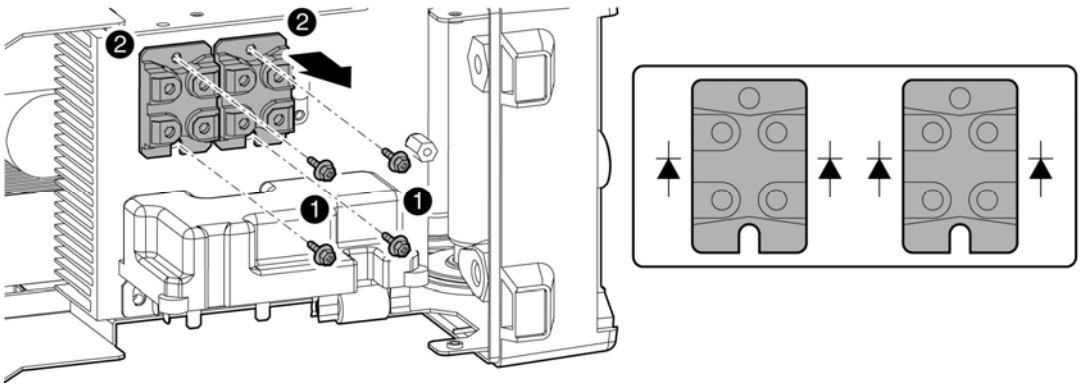
7. PCB7 (WK-5460) and Q3A-Q4C “Primary IGBT”
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the four screws and two IGBT Spring Clips. Remove the cables from edge holder.



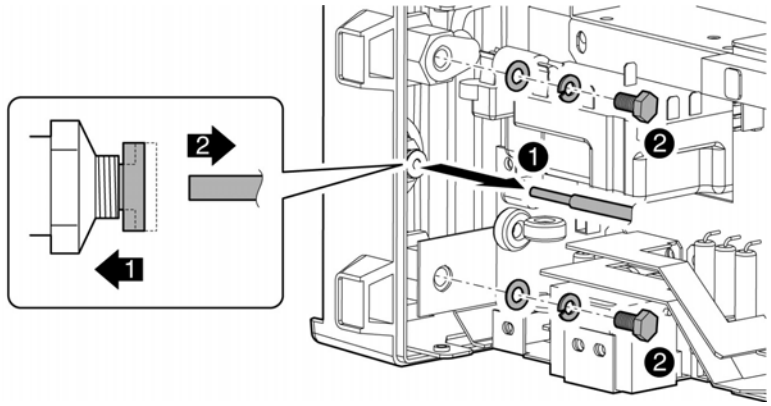
   c) Disconnect the connector CN1 on the PCB6. Cut the lead of the Q3-Q4C.
      *Remember to install new Silicone Rubber Sheets where silicone compound (Shinetsu Silicone G-747 or equivalent) was spread when reinstalling the PCB7. Spread the silicone compound on IGBT.



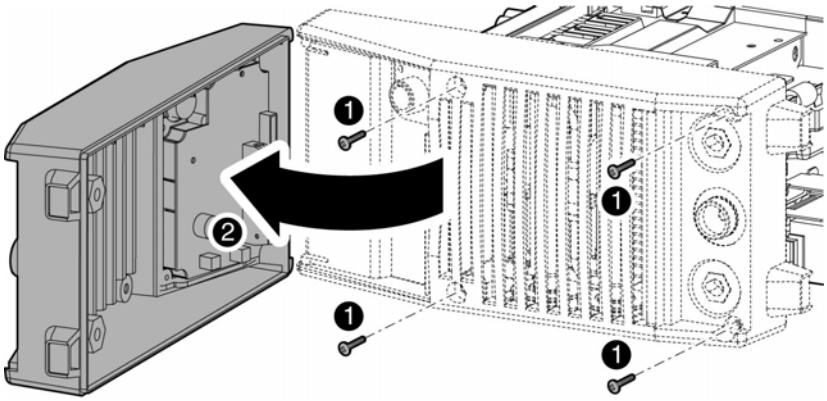
8. D2 and D3 “Secondary Diode”
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove PCB3 (WK-5569) and T1. See section “12.03.3”.
   c) Remove six screws and then detach the D2 and D3.
      *Do not have the wrong direction of the diodes when reinstalling.
      *Before installing a new diode, apply a uniform coat of silicone compound (Shinetsu Silicone G-747 or equivalent) on the base.



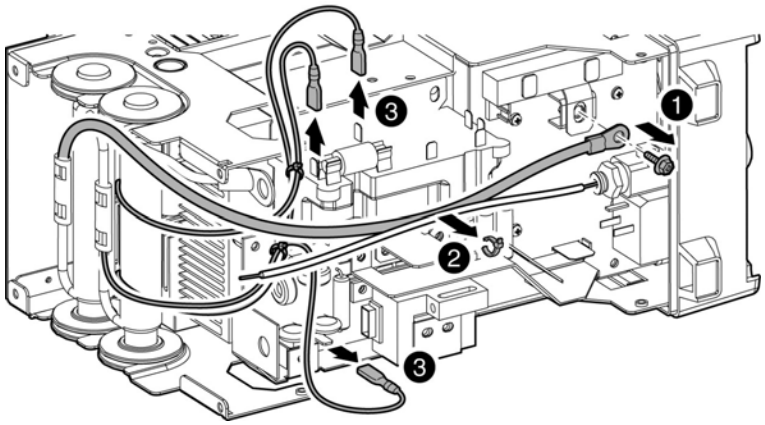
9. C.C. “Coupling Coil”* and FCH1 “Reactor”
   a) Remove the Side Panel. See section “11.01.1”.
   b) Remove the Gas Tube*. Remove the two bolts, two toothed washers, and the terminal.



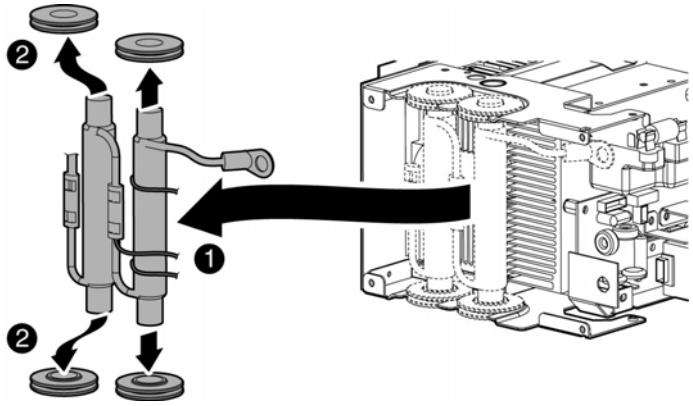
   c) Remove the four screws and the Front Panel.



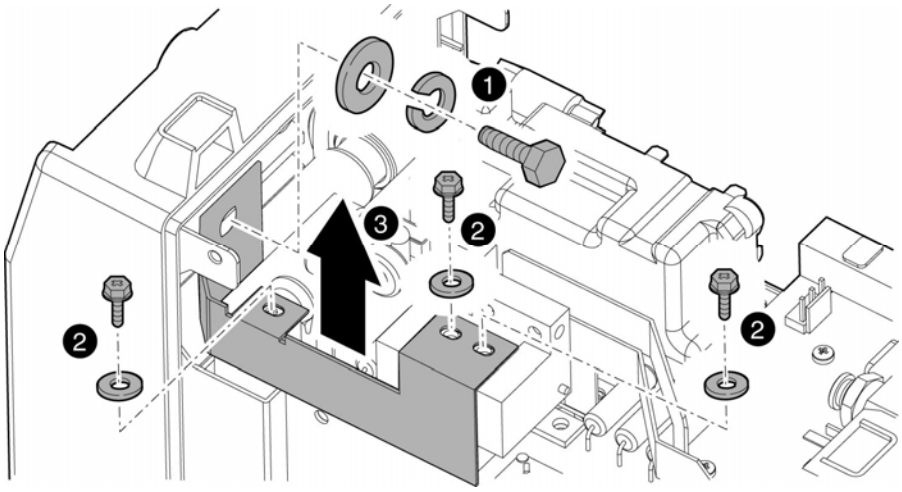
   d) Remove the screw and then remove the cable. Remove the two terminals from HF. UNIT. Remove the terminal from PCB3.



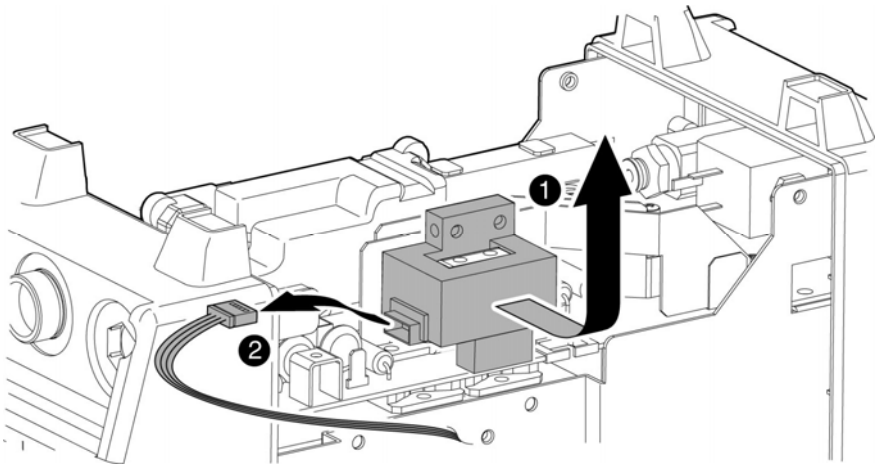
e) Remove the C.C. and FCH1.



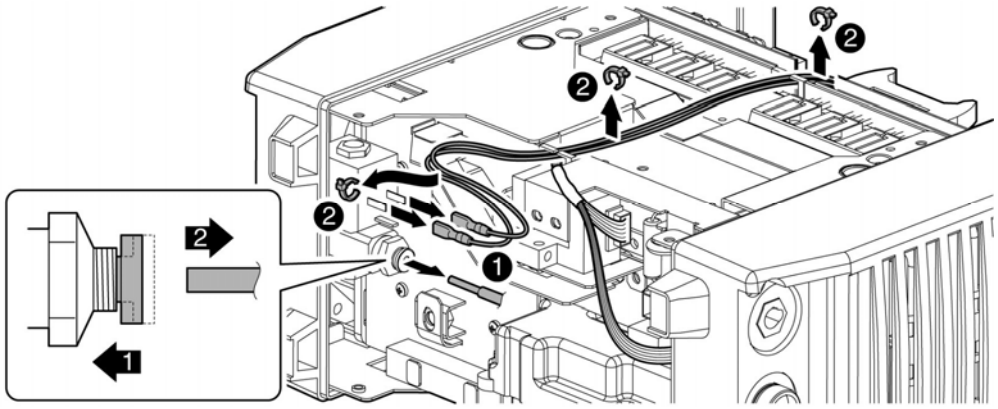
10. CT1 “Hole Current Trans”
    a) Remove the Side Panel. See section “11.01.1”.
    b) Remove the bolts, the spring, and the washer. Remove the three screws and then remove the Output Bus Bar.



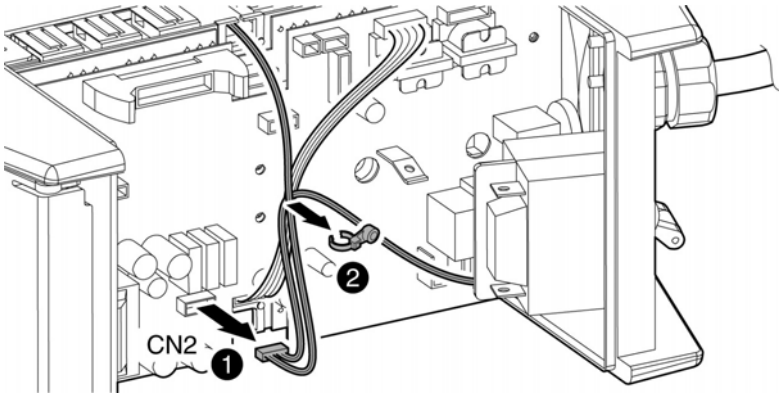
c) Remove the CT1. Disconnect the connector.



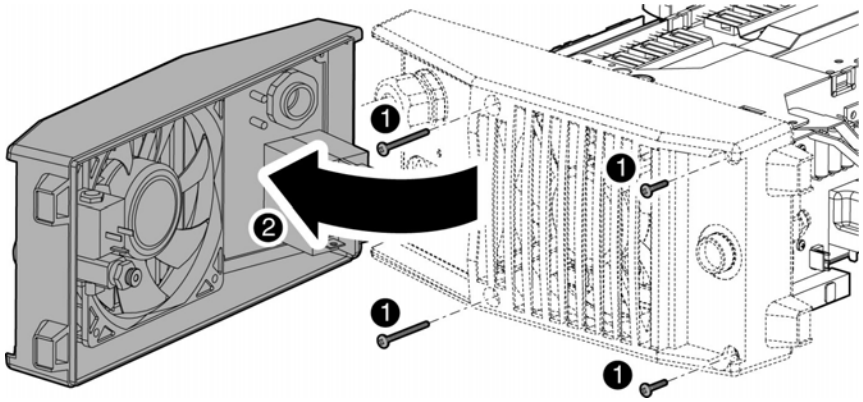
11. FAN1 “Cooling Fan”
    a) Remove the Side Panel. See section “11.01.1”.
    b) Remove the Gas Tube. Remove the two terminals and Cut the three snap bands.



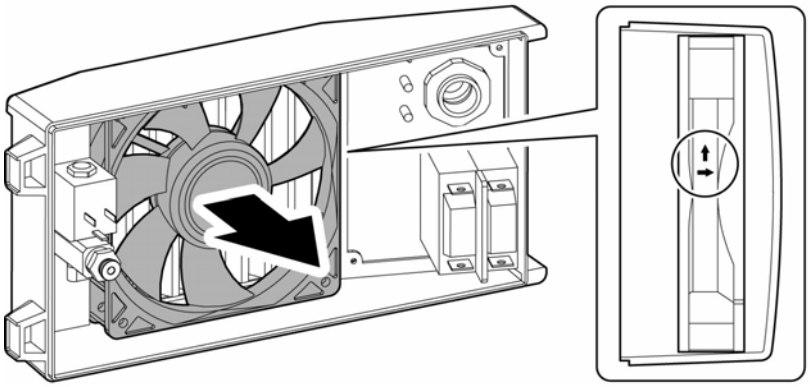
    c) Disconnect the connector CN2 on the PCB1 and Cut the snap band.



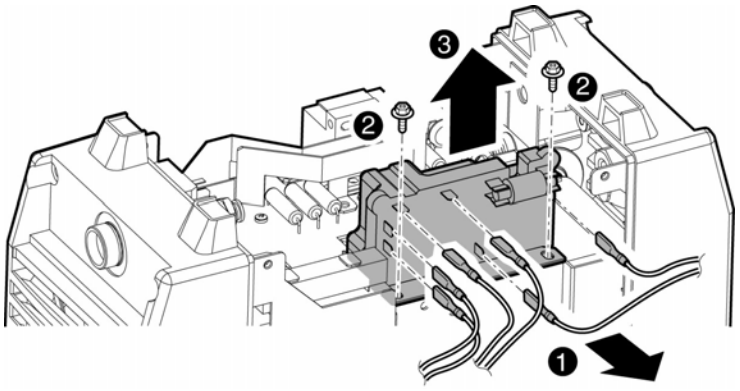
    d) Remove the four screws and then open the Rear Panel.



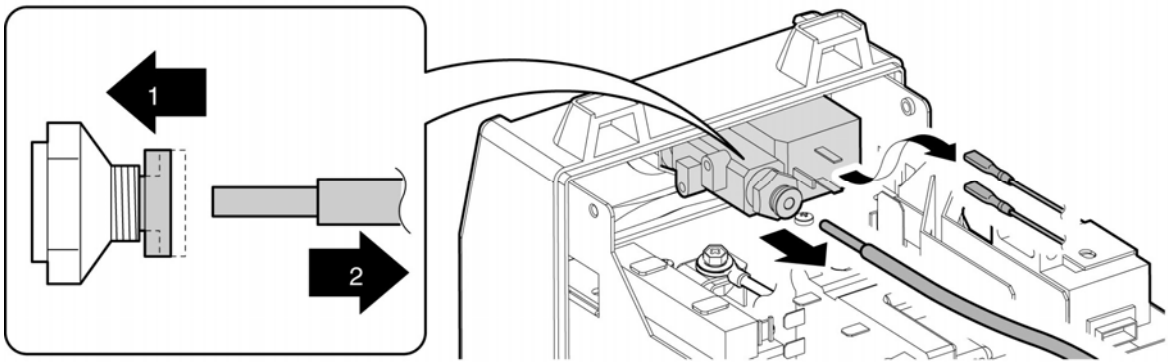
e) Remove the FAN1.
*Do not place the fan in the wrong direction when reinstalling.



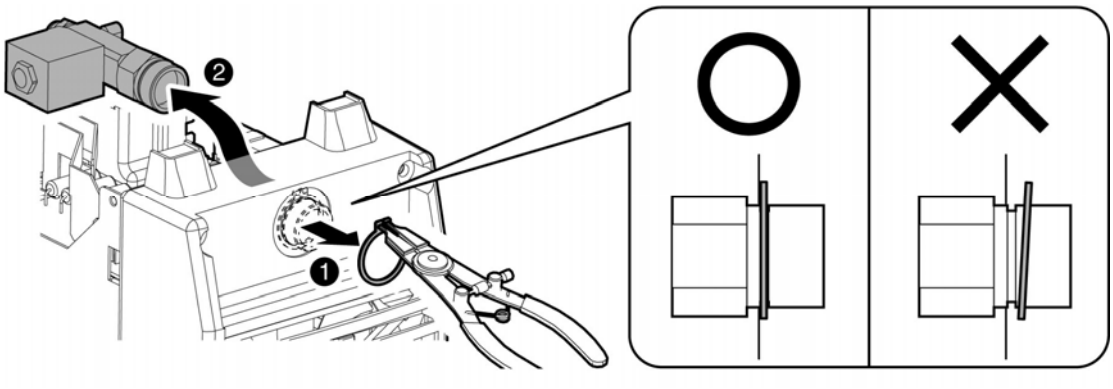
12. HF UNIT1 “High Frequency Unit”
a) Remove the Side Panel. See section “11.01.1”.
b) Remove the high frequency gap. Remove the four terminals.
c) Remove the two screws and the two washers. Detach the HF UNIT1.



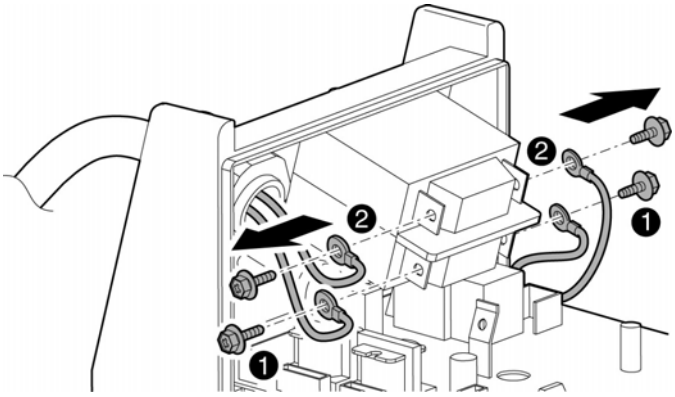
13. SOL1 “Solenoid GAS Valve”
a) Remove the Side Panel. See section “11.01.1”.
b) Remove the Gas Tube and two terminals.



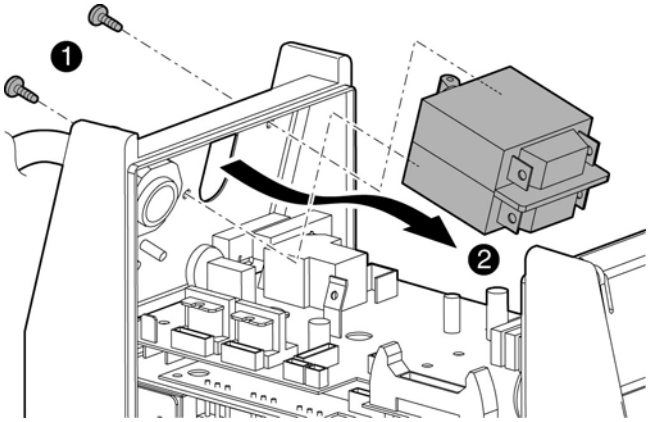
c) Remove the C-ring and then detach the SOL1.
*When reinstalling, make sure that the C-ring seats in the solenoid valve groove.



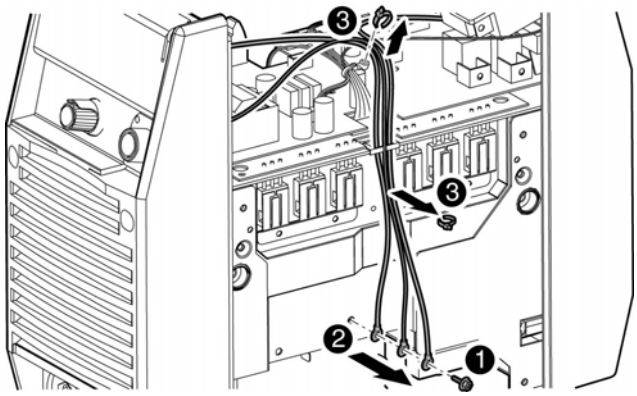
14. S1 “Switch”
a) Remove the Side Panel. See section “11.01.1”.
b) Remove the four screws and the four cables.



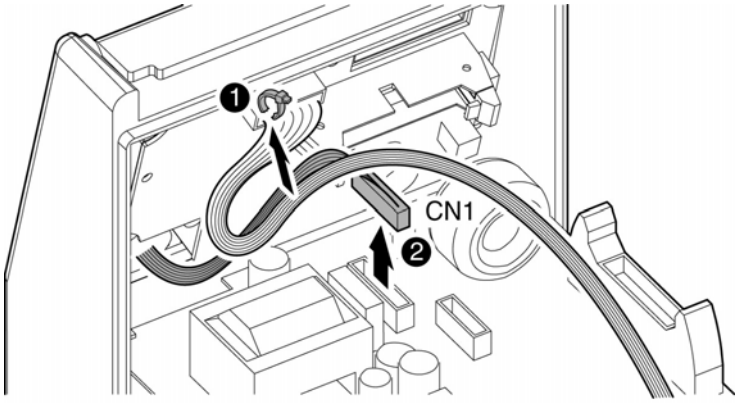
c) Remove the two screws and then detach the S1.



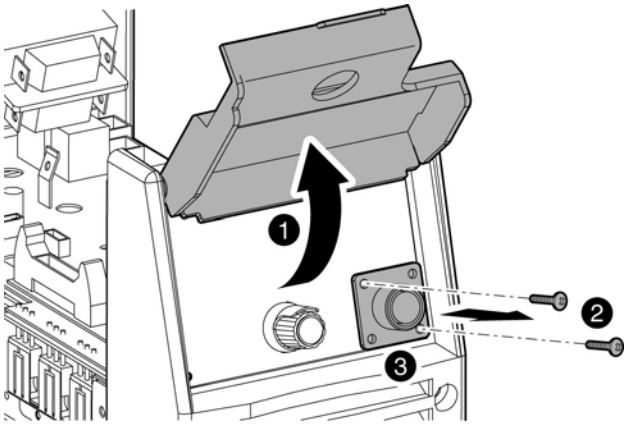
15. CON1 “Remote Receptacle”
  a) Remove the Side Panel. See section “11.01.1”.
  b) Remove the screw and then three ground cables. Cut the two snap bands.



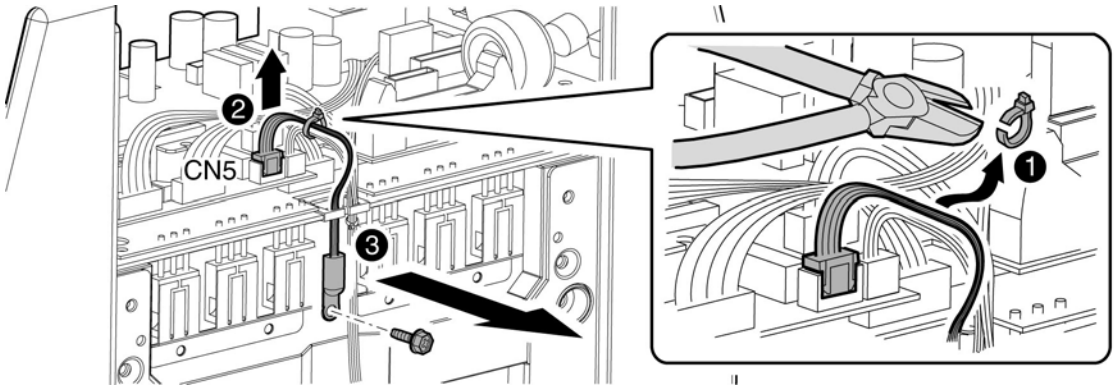
  c) Cut the snap band and disconnect connector CN1 on the PCB1.



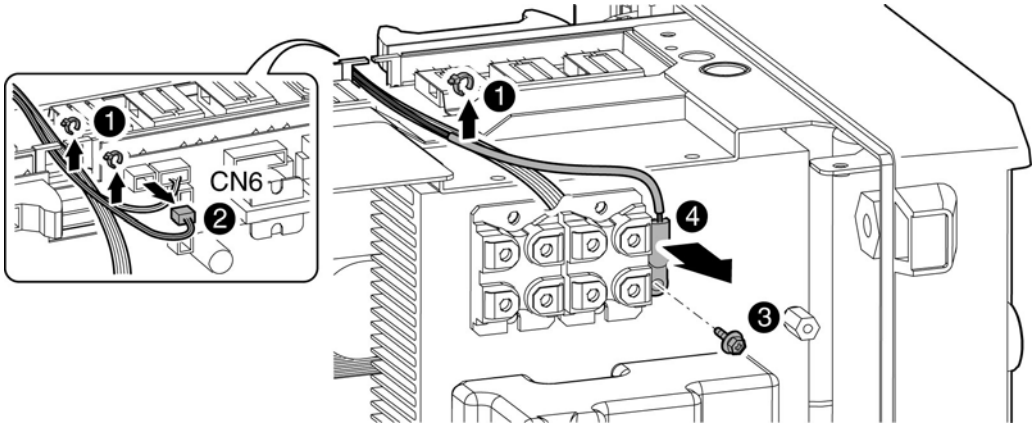
  d) Open the Panel Protects. Remove the two screws and the CON1.



16. TH1 “Primary Thermistor”
    a) Remove the Side Panel. See section “11.01.1”.
    b) Remove the snap band. Disconnect the connector CN5 on the PCB1. Remove the screw and then detach the TH1. Before installing a new Thermistor, apply a uniform coat of silicone compound (Shinetsu Silicone G-747 or equivalent) on the base.



17. TH2 “Secondary Thermistor”
    a) Remove the Side Panel. See section “11.01.1”.
    b) Remove PCB3 unit. See section “12.03.3”.
    c) Cut the three snap bands. Disconnect the connector CN6 on the PCB1. Remove the screw and then detach the TH1. Before installing a new Thermistor, apply a uniform coat of silicone compound (Shinetsu Silicone G-747 or equivalent) on the base.



APPENDIX A:
PARTS LIST

1 Equipment Identification

All identification numbers as described in the Introduction chapter must be furnished when ordering parts or making inquiries. This information is usually found on the nameplate attached to the equipment. Be sure to include any dash numbers following the Part or Assembly numbers.

2 How To Use This Parts List

The Parts List is a combination of an illustration and a corresponding list of parts which contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except for commercially available hardware, bulk items such as wire, cable, sleeving, tubing, etc., and permanently attached items which are soldered, riveted, or welded to other parts. The part descriptions may be indented to show part relationships. To determine the part number, description, quantity, or application of an item, simply locate the item in question from the illustration and refer to that item number in the corresponding Parts List.

PART NUMBER: 10-3067

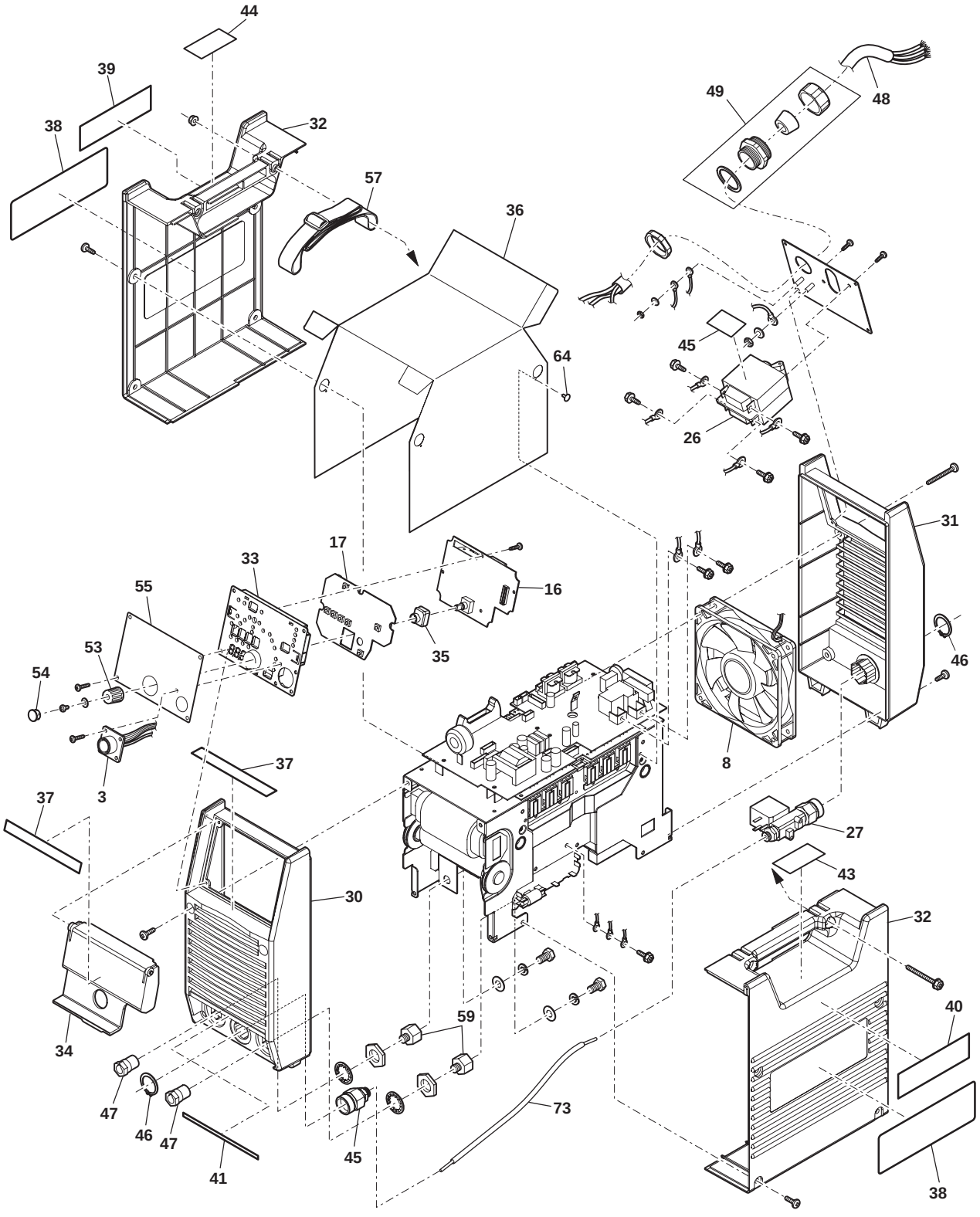
ARC MASTER 160TS

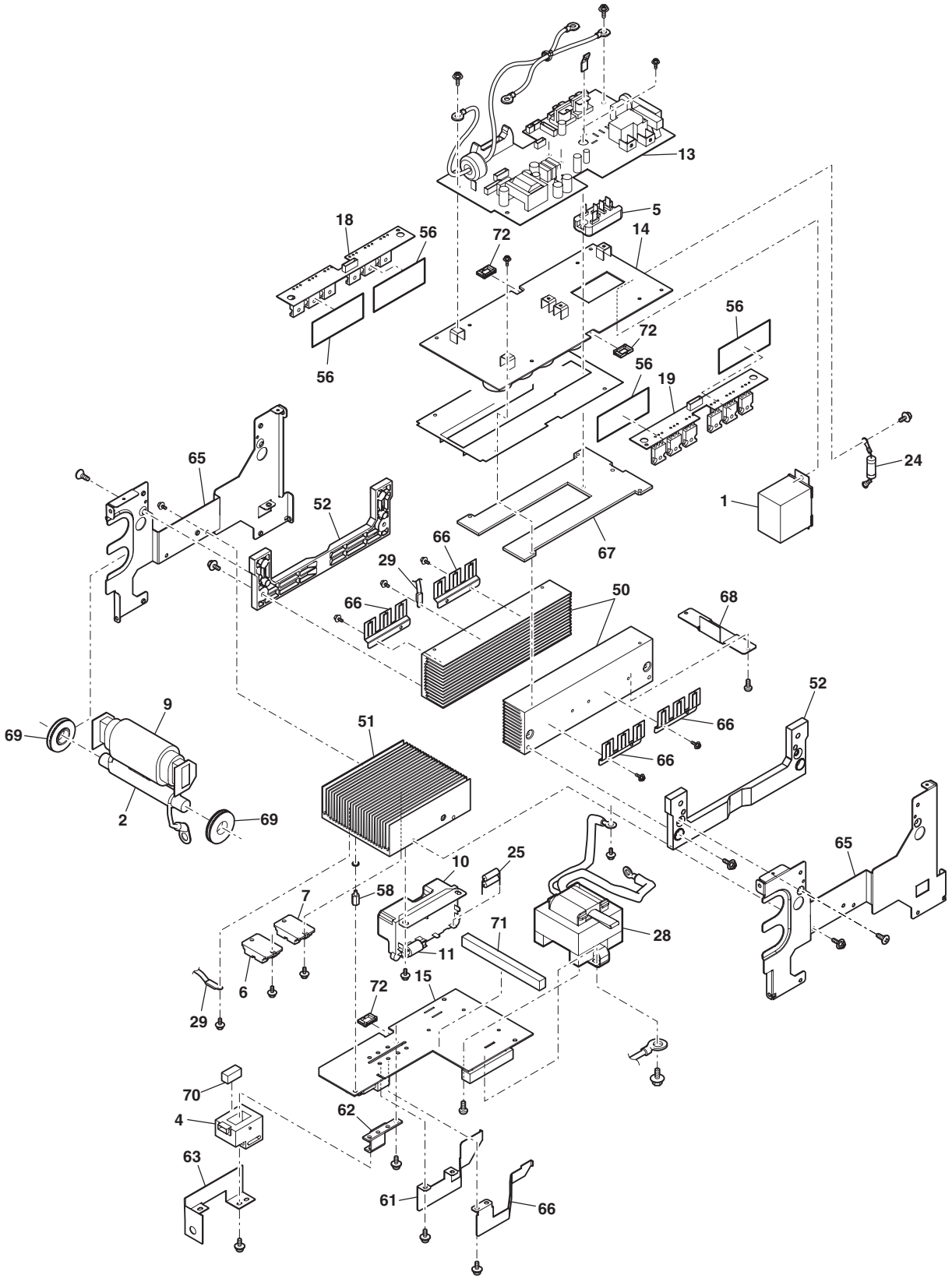
No.	DWG No.	Part No.	Description	Additional Information	QTY.
1	C1	10-6510	Capacitor, gen 3.1, IPS	SS351206PP1 DC350V 20uF (CAPACITOR)	1
2	C.C.	W7001384	Coil, Coupling, gen 3.1, IPS	F3A040600 200A (COUPING COIL)	1
3	CON1	10-6838	Socket, Remote, gen 3.1, IPS	206433-1 8P with Wiring Assembly (REMOTE CONNECTOR)	1
4	CT1	10-5003	Sensor, Current, gen 3.1, IPS	HC-TN200V4B15M 200A 4V (CURRENT TRANSFORMER)	1
5	D1	W7001481	Diode, gen 3.1, IPS	DF30DB80 (PRIMARY DIODE)	1
6	D2	10-6629	Diode, gen 3.1, IPS	DBA200UA60 (SECONDARY DIODE)	1
7	D3	10-6629	Diode, gen 3.1, IPS	DBA200UA60 (SECONDARY DIODE)	1
8	FAN1	10-5227	Fan, gen 3.1, IPS	D12T24PS101 (COOLING FAN)	1
9	FCH1	W7001502	Inductor, gen 3.1, IPS	F3A285001 1601200A FCH (REACTOR)	1
10	HF UNIT	W7001399	HF, Unit, gen 3.1, IPS	WK-4840 U04 (HIGH FREQUENCY UNIT)	1
11		10-6633	HF, Gap, gen 3.1, IPS	U0A601100	1
12	L1	10-6538	Inductor, gen 3.1, IPS	1615MRE (RING CORE)	1
13	PCB1	W7001403	PCB, gen 3.1, IPS	WK-5466 U03 (D/D PCB)	1
14	PCB2	W7001405	PCB, gen 3.1, IPS	WK-5467 U01 (MAIN PCB)	1
15	PCB3	W7001520	PCB, gen 3.1, IPS	WK-5609 U01 (2ND_DIODE PCB)	1
16	PCB4	W7001412	PCB, gen 3.1, IPS	WK-5449 U01 (CONTROL PCB)	1
17	PCB5	W7001724	PCB, gen 3.1, IPS	WK-5448 U04-2 (PANEL PCB)	1
18	PCB6	W7001516	PCB, gen 3.1, IPS	WK-5460 U01 (GATE PCB)	1
19	PCB7	W7001516	PCB, gen 3.1, IPS	WK-5460 U01 (GATE PCB)	1
20	Q1A-1C	W7001445	Transistor, gen 3.1, IPS	IRGP20B60PD 600V 22A (TRANSISTOR)	3
21	Q2A-2C	W7001445	Transistor, gen 3.1, IPS	IRGP20B60PD 600V 22A (TRANSISTOR)	3
22	Q3A-3C	W7001445	Transistor, gen 3.1, IPS	IRGP20B60PD 600V 22A (TRANSISTOR)	3
23	Q4A-4C	W7001445	Transistor, gen 3.1, IPS	IRGP20B60PD 600V 22A (TRANSISTOR)	3
24	R1	W7001448	Resistor, gen 3.1, IPS	ERG3ANJ103 3W 10kW (RESISTOR)	1
25	R3, R4	W7001449	Resistor, gen 3.1, IPS	ERG3SJ220H 3W 22Ω (RESISTOR)	2
26	S1	W7001453	Switch, gen 3.1, IPS	DCP-52SR50C-480V 2P-480V (MAIN ON/OFF SWITCH)	1
27	SOL1	10-6645	Valve Solenoid, gen 3.1, IPS	5505NBR1.5 DC24V 11VA/10W with Gas Inlet and PC4-02 (SOLENOID VALVE)	1
28	T1	W7001501	Transformer, gen 3.1, IPS	F3A013701 200A MTR (TRANSFORMER)	1
29	TH1, TH2	10-5228	Thermistor, gen 3.1, IPS	ERTA53D203 20KΩ/25°C B=3950K (THERMISTOR)	2

160TS PARTS LIST

No.	DWG No.	Part No.	Description	Additional Information	QTY.
30		W7001458	Panel, Front, gen 3.1, IPS	E0D004501	1
31		W7001459	Panel, Rear, gen 3.1, IPS	E0D004601	1
32		W7001457	Label, Side, gen 3.1, IPS	E0D004707	2
33		W7001460	Case, Front Control, gen 3.1, IPS	E0C341900	1
34		10-6653	Cover, Protector, gen 3.1, IPS	E0C303200	1
35		10-6791	Cover, Encoder, gen 3.1, IPS	EBA514400	1
36		10-6705	Cover, PCB, gen 3.1, IPS	E1B550900 (with Caution Label)	1
37		W7001566	Label, Name, gen 3.1, IPS	N4A932600	2
38		W7001512	Label, Side, gen 3.1, IPS	N4A785100	2
39		W7001508	Label, 1 Warning, gen 3.1, IPS	N1B029500	1
40		W7001509	Label, 2 Warning, gen 3.1, IPS	N1B029600	1
41		10-6732	Label, Output, gen 3.1, IPS	N4A040000	1
42		10-6733	Label, Gas Input, gen 3.1, IPS	N4A040700	1
43		W7001513	Label, VRD, gen 3.1, IPS	N4A918800	1
44		W7001511	Label, VRD, gen 3.1, IPS	N4A598700	1
45		10-6659	Outlet, Gas, gen 3.1, IPS	E5A925600 (with PC4-02)	1
46		10-5184	C-Ring, gen 3.1, IPS		2
47		10-6660	Output, Terminal F, gen 3.1, IPS	TRAK-BE35-70S	2
48		N/A	Input Cable, gen 3.1, IPS	132"12/3 SOW BLKW/5-15P	1
49		W7001484	Clamp, Input, gen 3.1, IPS	SCLB14A	1
50		W7001489	Heatsink, gen 3.1, IPS	E1B834200	2
51		W7001490	Heatsink, gen 3.1, IPS	E1B836800	1
52		W7001488	Insulated Board, gen 3.1, IPS	E1B834100	2
53		10-6665	Knob, gen 3.1, IPS	2621603	1
54		10-6666	Knob Cap, gen 3.1, IPS	3021104	1
55		W7001565	Cover, Protector, gen 3.1, IPS	N1B036400	1
56		W7001493	Terminal Sheet, gen 3.1, IPS	ECA775700	4
57		10-5069	Strap, gen 3.1, IPS	E5A937000	1
58		W7001496	Post, 1 (M4-M4), gen 3.1, IPS	ECA793500 (M4-M4)	2
59		W7001495	Post, Output, gen 3.1, IPS	ECA790900 (M8-M8)	2
60		W7001499	Bus Bar, T-D1, gen 3.1, IPS	ECA848700	1
61		W7001500	Bus Bar, 2 T-D, gen 3.1, IPS	ECA848800	1
62		W7001492	Bus Bar, CT1, gen 3.1, IPS	ECA775600	1
63		W7001494	Bus Bar, Output, gen 3.1, IPS	ECA788600	1
64		W7001374	Clip, gen 3.1, IPS	#74 NATURAL	4
65		W7001503	Chassis, gen 3.1, IPS	J4B983800	1
66		W7001487	Clip,Spring IGBT, gen 3.1, IPS	E1B832400	4
67		W7001504	Chassis, D1, gen 3.1, IPS	JEA280400	1
68		W7001505	Chassis, C1, gen 3.1, IPS	JEA280600	1
69		W7001563	Support Board, gen 3.1, IPS	ECA774900	2
70		W7001498	Cushion, CT1, gen 3.1, IPS	ECA793900	1
71		W7001497	Cushion, Dust, gen 3.1, IPS	ECA793800	1
72		W7001485	Holder, Edge, gen 3.1, IPS	EH11U	3
73		10-6681	Hose, Nylon, gen 3.1, IPS	T0425B Nylon Hose L=0.5m	1
74		300x4858	Operating Manual, gen 3.1, IPS	Operating Manual 160TS	1

160TS PARTS LIST

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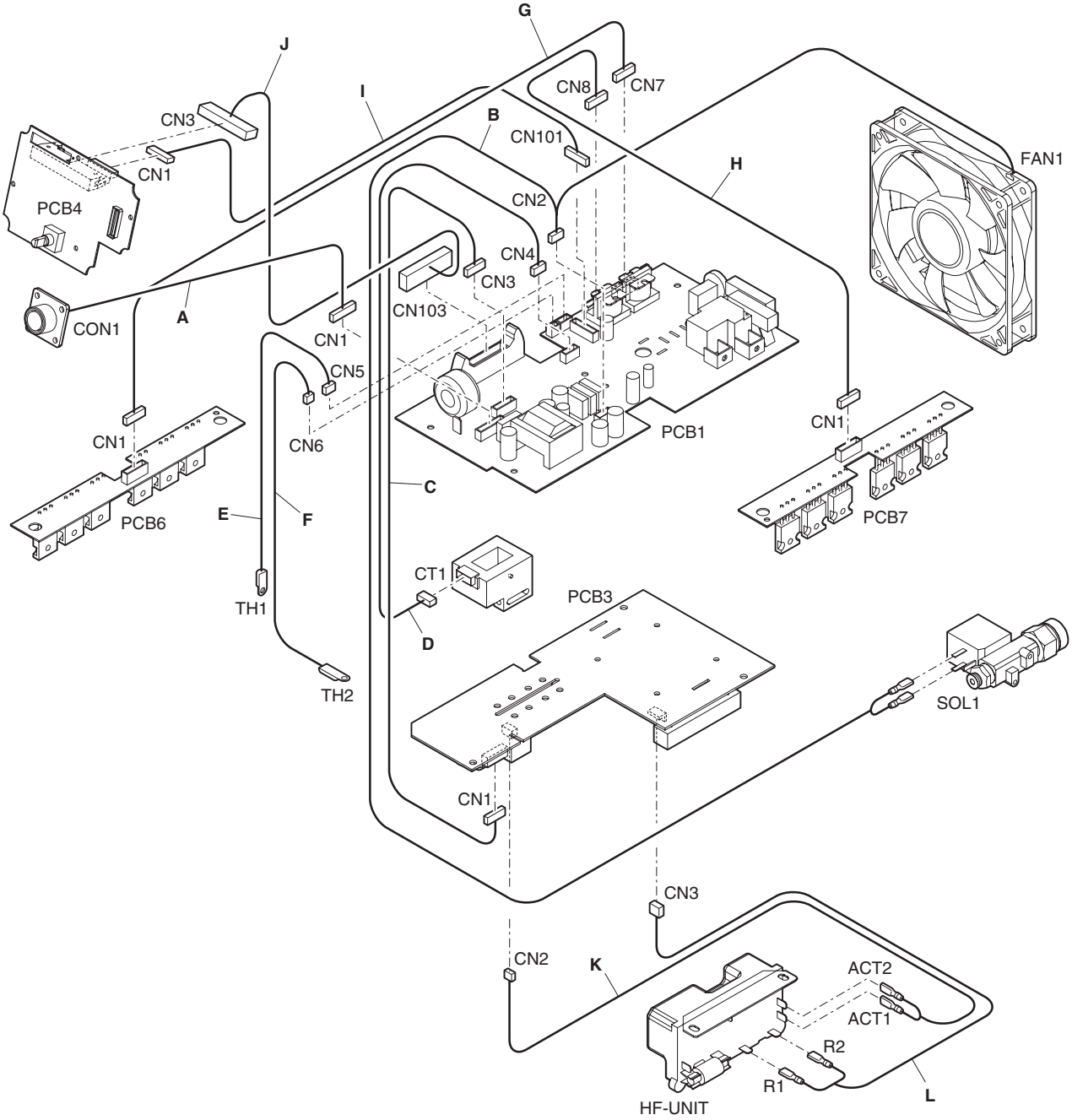
APPENDIX 2 CONNECTION WIRING GUIDE

	Destination			Destination	
A	PCB1	CN1	↔	CON1	
B	PCB1	CN2	↔	FAN1	
				SOL1	
C	PCB1	CN3	↔	PCB3	CN1
D	PCB1	CN4	↔	CT1	
E	PCB1	CN5	↔	TH1	
F	PCB1	CN6	↔	TH2	
G	PCB1	CN7	↔	PCB6	CN1
H	PCB1	CN8	↔	PCB7	CN1
I	PCB1	CN101	↔	PCB4	CN1
J	PCB1	CN103	↔	PCB4	CN3
K	PCB3	CN2	↔	HF UNIT	
L	PCB3	CN3	↔	HF UNIT	


G
J
I
B
CN8
CN7
CN3
CN101
FAN1
CN1
H
PCB4
CN2
CN4
CN3
CON1
A
CN103
CN1
CN5
CN1
CN6
PCB1
CN1
C
E
F
PCB6
PCB7
CT1
PCB3
TH1
D
TH2
SOL1
CN1
CN3
CN2
K
ACT2
ACT1
R2
R1
L
HF-UNIT

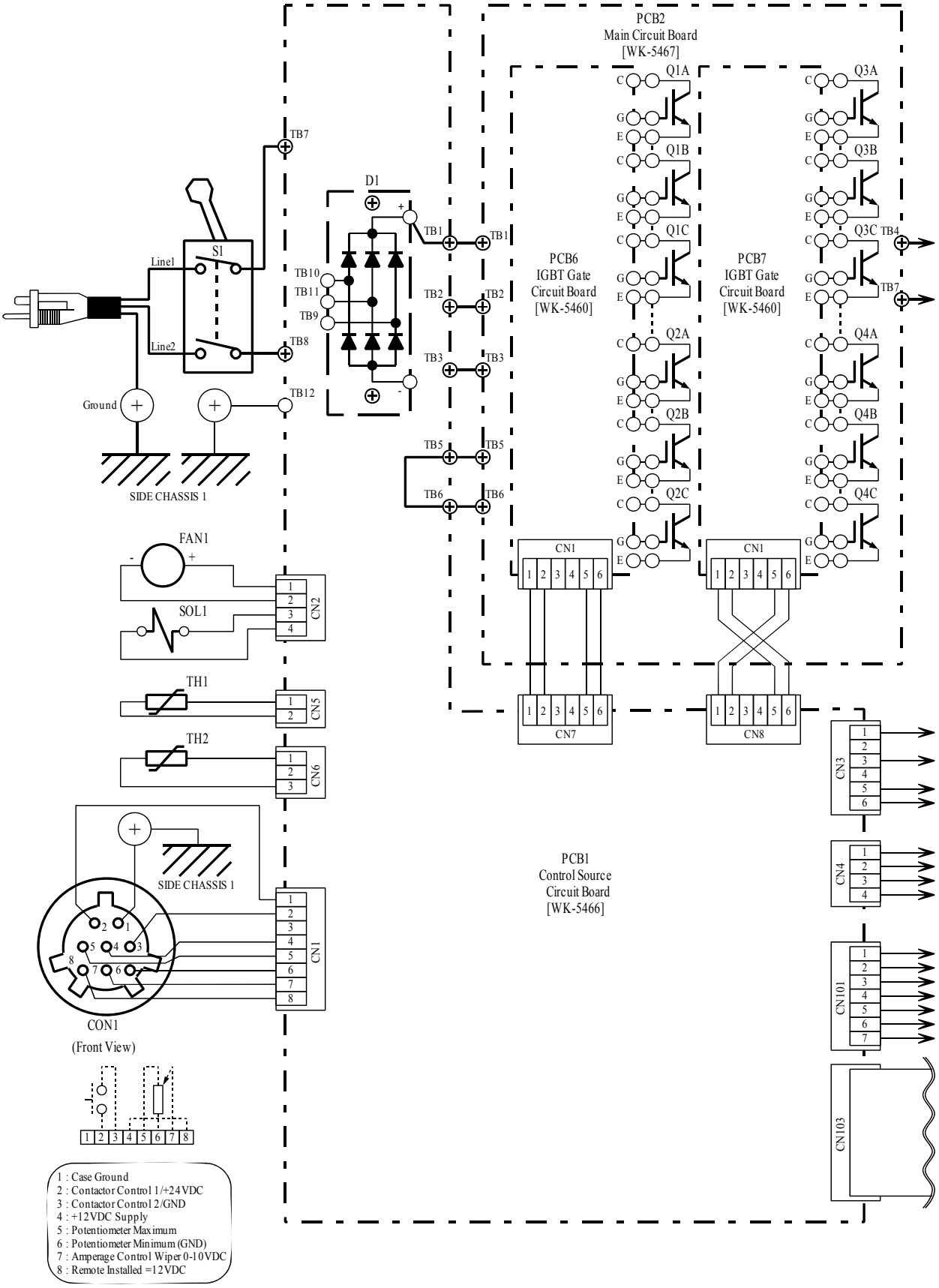
2. Connection Wire List

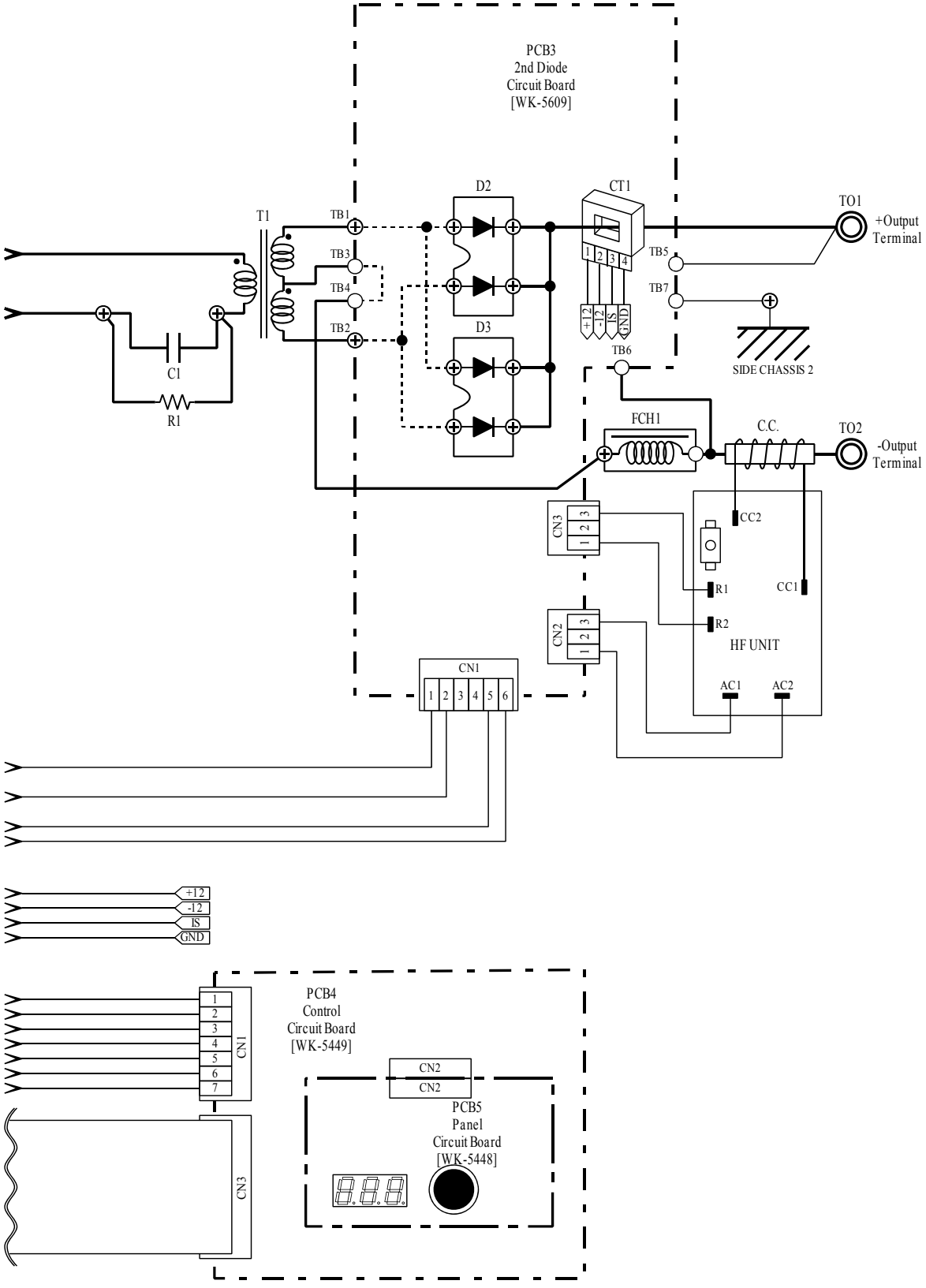
PCB1 WK-5466	PCB3 WK-5609	PCB4 WK-5449	PCB6 WK-5460	PCB7 WK-5460	Device No.	SIGNAL NAME
CN103-1		CN3-1				GND
CN103-2		CN3-2				Output Current Signal
CN103-3		CN3-3				Output Voltage signal
CN103-4		CN3-4				Torch Switch signal
CN103-5		CN3-5				Panel / Remote signal
CN103-6		CN3-6				GND
CN103-7		CN3-7				Potentiometer Max
CN103-8		CN3-8			D1+	Potentiometer Wiper
CN103-9		CN3-9			D1-G	GND
CN103-10		CN3-10			FAN+	FAN signal
CN103-11		CN3-11			FAN-	GND
CN103-12		CN3-12			SOL1(P)	Primary Current signal
CN103-14		CN3-14			SOL1(N	GND
CN103-15		CN3-15				Pre-start complete
CN103-16		CN3-16				115V / 230V detect signal
CN103-17		CN3-17				Error signal
CN103-19		CN3-19				Thermal Sensor1
CN103-20		CN3-20				Thermal Sensor1
CN103-21		CN3-21				Thermal Sensor2
CN103-22		CN3-22				Thermal Sensor2
CN103-24		CN3-24				HF signal
CN103-25		CN3-25				Gas signal
CN103-26		CN3-26				Short Detect signal
CN101-1		CN1-1				+12VDC
CN101-2		CN1-2				+5VDC
CN101-3		CN1-3				-12VDC
CN101-4		CN1-4				GND
CN101-5		CN1-5				IGBT Gate signal(E)
CN101-6		CN1-6				IGBT Gate signal(G)
CN101-7		CN1-7				GND
CN4-1					HCT1-1	+12VDC
CN4-2					HCT1-2	-12VDC
CN4-3					HCT1-3	Current signal
CN4-4					HCT1-4	GND
CN5-1						Thermal Sensor1
CN5-2						Thermal Sensor1
CN6-1						Thermal Sensor2
CN6-3						Thermal Sensor2
CN2-1					FAN+	FAN+
CN2-2					FAN-	FAN-
CN2-3					SOL1	SOL1 (P)
CN2-4					SOL1	SOL1 (N)
CN7-1			CN1-1			IGBT Gate signal(E)
CN7-2			CN1-2			IGBT Gate signal(G)
CN7-5			CN1-5			IGBT Gate signal(E)
CN7-6			CN1-6			IGBT Gate signal(G)
CN8-1				CN1-5		IGBT Gate signal(E)
CN8-2				CN1-6		IGBT Gate signal(G)
CN8-5				CN1-1		IGBT Gate signal(E)
CN8-6				CN1-2		IGBT Gate signal(G)

Connection Wire List (continued)

PCB1 WK-5466	PCB3 WK-5609	PCB4 WK-5449	PCB6 WK-5460	PCB7 WK-5460	Device No.	SIGNAL NAME
CN3-1	CN1-1					GND
CN3-3	CN1-3					Short Detect signal
CN3-5	CN1-5					+12VDC
CN3-6	CN1-6					HF signal
	CN2-1				HF. UNIT AC2	HF Input Voltage
	CN3-3				HF. UNIT AC1	HF Input Voltage
CN1-2					CON1-2	Contactor Control (+12V)
CN1-3					CON1-3	Contactor Control (GND)
CN1-4					CON1-4	Panel / Remote signal
CN1-5					CON1-5	Potentiometer Max
CN1-6					CON1-6	Potentiometer Min (GND)
CN1-7					CON1-7	Potentiometer Wiper
CN1-8					CON1-8	Panel / Remote signal

APPENDIX C:
CONNECTION DIAGRAM




PCB3
2nd Diode
Circuit Board
[WK-5609]
T1
TB1
TB3
TB4
TB2
D2
D3
CT1
TO1
+Output
Terminal
TB5
TB7
TB6
SIDE CHASSIS 2
C1
R1
FCH1
C.C.
TO2
-Output
Terminal
CN3
CN2
CN1
CC2
CC1
R1
R2
HF UNIT
AC1
AC2
+12
-12
IS
GND
PCB4
Control
Circuit Board
[WK-5449]
CN2
CN2
PCB5
Panel
Circuit Board
[WK-5448]

APPENDIX D:
DIODE TESTING BASICS

Testing of diode modules requires a digital Volt/Ohmmeter that has a diode test scale.

1. Locate the diode module to be tested.
2. Remove cables from mounting studs on diodes to isolate them within the module.
3. Set the digital volt/ohm meter to the diode test scale.
4. Using figure 1 and 2, check each diode in the module. Each diode must be checked in both the forward bias (positive to negative) and reverse bias (negative to positive) direction.
5. To check the diode in the forward bias direction, connect the volt/ohm meter positive lead to the anode (positive, +) of the diode and the negative lead to the cathode (negative, -) of the diode (refer to figure 1). A properly functioning diode will conduct in the forward bias direction, and will indicate between 0.3 and 0.9 volts.
6. To check the diode in the reverse bias direction, reverse the meter leads (refer to figure 1). A properly functioning diode will block current flow in the reverse bias direction, and depending on the meter function, will indicate an open or "OL".
7. If any diode in the module tests as faulty, replace the diode module.
8. Reconnect all cables to the proper terminals.

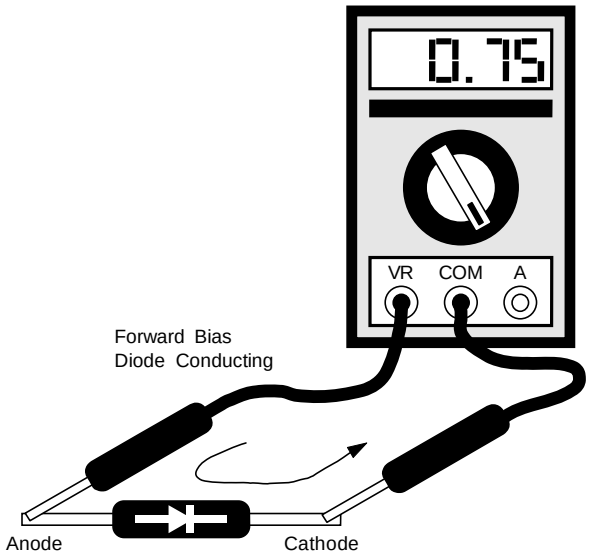


Figure D-1 Forward bias diode test

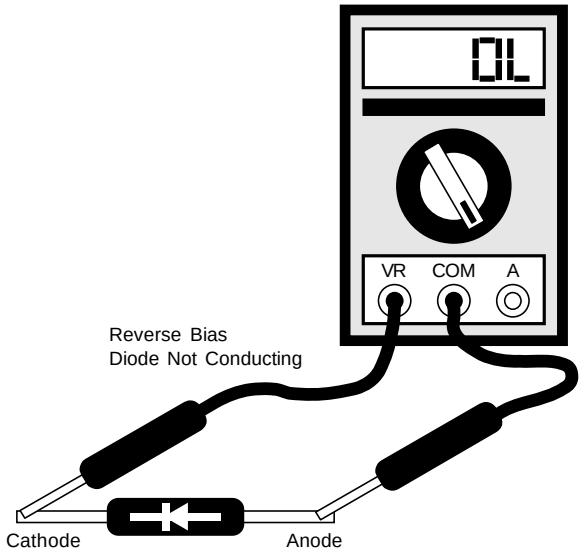


Figure D-2 Reverse bias diode tes

LIMITED WARRANTY

This information applies to Thermal Arc products that were purchased in the USA and Canada.

April 2006

LIMITED WARRANTY: Thermal Arc®, Inc., A Thermadyne Company ("Thermal Arc"), warrants to customers of authorized distributors ("Purchaser") that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the warranty period stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or damage, correct such defects by suitable repair or replacement, at Thermal Arc's sole option, of any components or parts of the product determined by Thermal Arc to be defective.

This warranty is exclusive and in lieu of any warranty of merchantability, fitness for any particular purpose, or other warranty of quality, whether express, implied, or statutory.

Limitation of liability: Thermal Arc shall not under any circumstances be liable for special, indirect, incidental, or consequential damages, including but not limited to lost profits and business interruption. The remedies of the purchaser set forth herein are exclusive, and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc, whether arising out of contract, tort, including negligence or strict liability, or under any warranty, or otherwise, shall not exceed the price of the goods upon which such liability is based.

No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty, and Thermal Arc shall not be bound by any such attempt. Correction of non-conformities, in the manner and time provided herein, constitutes fulfillment of thermal's obligations to purchaser with respect to the product.

This warranty is void, and seller bears no liability hereunder, if purchaser used replacement parts or accessories which, in Thermal Arc's sole judgment, impaired the safety or performance of any Thermal Arc product. Purchaser's rights under this warranty are void if the product is sold to purchaser by unauthorized persons.

The warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

Warranty repairs or replacement claims under this limited warranty must be submitted to Thermal Arc via an authorized Thermal Arc repair facility within thirty (30) days of purchaser's discovery of any defect. Thermal Arc shall pay no transportation costs of any kind under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the Purchaser. All returned goods shall be at the Purchaser's risk and expense. This warranty dated April 1st 2006 supersedes all previous Thermal Arc warranties. Thermal Arc® is a Registered Trademark of Thermal Arc, Inc.

WARRANTY SCHEDULE

This information applies to Thermal Arc products that were purchased in the USA and Canada.

April 2006

ENGINE DRIVEN WELDERS	WARRANTY PERIOD	LABOR
Scout, Raider, Explorer		
Original Main Power Stators and Inductors	3 years	3 years
Original Main Power Rectifiers, Control P.C. Boards	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year
Engines and associated components are NOT warranted by Thermal Arc, although most are warranted by the engine manufacturer	See the Engine's Warranty for Details	

GMAW/FCAW (MIG) WELDING EQUIPMENT	WARRANTY PERIOD	LABOR
Fabricator 131, 181; 190, 210, 251, 281; Fabstar 4030; PowerMaster 350, 350P, 500, 500P; Excelarc 6045. Wire Feeders; Ultrafeed, Portafeed		
Original Main Power Transformer and Inductor	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.	1 year	1 year

GTAW (TIG) & MULTI-PROCESS INVERTER WELDING EQUIPMENT	WARRANTY PERIOD	LABOR
160TS, 300TS, 400TS, 185AC/DC, 200AC/DC, 300AC/DC, 400GTSW, 400MST, 300MST, 400MSTP		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors.	1 year	1 year

PLASMA WELDING EQUIPMENT	WARRANTY PERIOD	LABOR
Ultima 150		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards, power switch semi-conductors	3 years	3 years
Welding Console, Weld Controller, Weld Timer	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, electric motors, Coolant Recirculator.	1 year	1 year

SMAW (Stick) WELDING EQUIPMENT	WARRANTY PERIOD	LABOR
Dragster 85		
Original Main Power Magnetics	1 year	1 year
Original Main Power Rectifiers, Control P.C. Boards	1 year	1 year
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year
160S, 300S, 400S		
Original Main Power Magnetics	5 years	3 years
Original Main Power Rectifiers, Control P.C. Boards	3 years	3 years
All other original circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year	1 year

GENERAL ARC EQUIPMENT	WARRANTY PERIOD	LABOR
Water Recirculators	1 year	1 year
Plasma Welding Torches	180 days	180 days
Gas Regulators (Supplied with power sources)	180 days	Nil
MIG and TIG Torches (Supplied with power sources)	90 days	Nil
Replacement repair parts	90 days	Nil
MIG, TIG and Plasma welding torch consumable items	Nil	Nil

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Chorley North Industrial Park
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England, PR6 7Bx
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Fax: 86-21-69171139

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Fax : 603+ 6092 1085

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